EDGAR J. BUTTENHEIM, President | THEODORE R. KENDALL, Editor | O. E. POTTER, Associate Editor | P. C. FORD, Secretary | HERBERT K. SAXE, Treasurer | MYRON MACLEOD, Advertising Manager

Contractors and Engineers Monthly

Vol. XVIII
No. 2

February,
1929

Published Monthly at 443 Fourth Ave., New York, by Buttenheim-Dix Publishing Corporation. *Branch Offices*: Tribune Tower, Chicago, Tom Dix, Vice-president: 410 Hanna Building, Cleveland, George Conover, Manager; 155 Montgomery St., San Francisco Roger A. Johnstone, Manager.

TABLE OF CONTENTS

BUILDING CONSTRUCTION
Foundation Conditions and Methods of Construction for the New North Station Development at Boston. 107

CONCRETE
Improvements in the Quality of Concrete in Fourteen Years 104

DAM CONSTRUCTION
Building a Dam by Hydraulic Sluicing in New York State 95

EQUIPMENT

ASPHALT MACHINERY
A New Asphalt Patching Plant..... 142

BACKFILLERS
A Backfiller Winch for Tractors..... 146

BATCHERS
An Improved Bin and Measuring Device..... 138

BUCKETS, CLAMSHELL AND ORANGEPEEL
Clamshell for Use With Light Crane..... 152

CONCRETE MACHINERY
A Truck Mounted Cylindrical Concrete Carrier.... 135
A New Truck Body for Ready Mixed Concrete.... 144
A Truck Body With Concrete Agitator..... 156

CONVEYORS
Scoop Conveyors for Material Handling..... 146

ENGINES, OIL, GAS AND DIESEL
Four-Cylinder Industrial Engines for Heavy Duty.. 148

EXCAVATORS
A New 2½-Yard Shovel..... 150
Heavy Duty ¾-Yard Shovel-Crane-Dragline..... 154

HOISTS AND WINCHES
A Double Drum Gasoline Hoist.. 158

LANTERNS AND TORCHES
A New Burner for Road Torches..... 150

LOCOMOTIVES, ELECTRIC, GAS, DIESEL AND STEAM
An Improved 5-Ton Industrial Locomotive..... 156

MISCELLANEOUS
An Improved Sheave-Block for Scrapers..... 140
A Miniature Screw Jack..... 154

PNEUMATIC MACHINERY
A Portable 250-Foot Air Compressor..... 136
A New Line of Portable Air Compressors..... 144

PORTABLE LIGHTING UNITS
A Portable Flood Light..... 152

PUMPS
New Drainage Pump Operated by Outboard Motor. 136
A Lightweight Portable Pumper 138
A Portable Self-Priming Centrifugal Pump..... 140
Side Suction Centrifugal Pump..... 150

REINFORCING STEEL AND SUPPORTS
Sleeves for Reinforcing Dowels and Form Bolts.... 146

ROAD MACHINERY
A 10-Ton Road Roller with a 6-Cylinder Motor.... 135
A One-Man Automatic Road Maintainer..... 142

ROOFING
Steel Sheathing for Roofs..... 144

SAND AND GRAVEL WASHERS
A New Type of Gravel Washer..... 154

SAWS
Electric Hand Saw Has New Features..... 148

SCREENS
Counterflow Screens With One, Two or Three Decks 156

SHOVELS, SCOOPS AND SPADES
A Light-Weight High Grade Hand Shovel..... 136

TRAILERS
Bottom-Dump All-Steel Tractor-Drawn Trailers.... 138

WHEELBARROWS
An Improved Wheelbarrow..... 142

WHEELS
Dual Wheels for Light Trucks..... 135

ITEMS OF INTEREST
Florida to Hold Open Air Road Show..... 100
Book Review—The Bridges of Pittsburgh..... 112
A 36-Ton Steam Shovel Plunges Through a Bridge..... 131
Paver Kept Level by Wedge-Shaped Platform on Steep Grades 106
Construction Industry News..... 132
1929 To Be Banner Road Year..... 140
San Francisco Toll Bridge to Be Opened March 1..... 142
A Selected List of Useful Material..... 160

LAW AND LITIGATION
Legal Points for Contractors.....130, 131, 133

RESPONSIBILITY OF CONTRACTORS
Treasury Department May Reject Bids of Irresponsible Contractors 123

ROAD CONSTRUCTION
Breaking a Traffic Bottle Neck Near Boston, Mass..... 101
Hauling with Heavy-Duty Trucks in Highway Grading. 103
A 5.22-Mile Grading Job in Rugged Country..... 117
Complete Oil Mix Plant Used on New Mexico Highway Construction..... 123
Subdrainage Stabilizes Fill and Subgrade on Illinois Relocation 126
Speeding Shoulder Construction on New Road..... 158

SAND AND GRAVEL PLANTS
A Caterpillar Sixty Operating a Sand and Gravel Plant (Photo)..... 100

SEWERAGE AND SEWAGE TREATMENT PLANTS
Sewage Treatment Plant Construction at Dayton, Ohio. 113
A Difficult Sewer Job Finished Three Months Ahead of Schedule 122

SPECIFICATIONS
Ambiguous Specifications Cause Undue Hardships..... 112
Specifications and Construction Recommendations for Vitrified Brick Pavement..... 128

SUPERVISION OF CONSTRUCTION
The City Engineer and the Contractor..... 129

WATER-WORKS CONSTRUCTION
Construction Features of a Water-Works Intake Cofferdam 120

WELDING
Bridge Anchor Bolts Lengthened by Welding..... 106
Training Welders for Diversified Work Necessary for Successful Operations..... 123

WHO'S WHO IN CONSTRUCTION
Reports from Active Contractors..... 131

WIRE CABLES
Wire Rope and Safety..... 124

For Directory of Local Distributors of Contractors' Equipment, See Pages 141 to 163

THE NEW LORAIN 55

HERE is power combined with speed that will master the toughest going. It is the new Lorain 55—a one-yard Center Drive Crane—Clamshell—Shovel—Dragline of the same outstanding design and construction as the famous Lorain 75.

THE THEW SHOVEL CO. · *Lorain, Ohio*
CRANES—DRAGLINES—SHOVELS
Gasoline or Electric Powered

THEW CENTER DRIVE

THEW

When writing to advertisers please mention the CONTRACTORS AND ENGINEERS MONTHLY—Thank You.

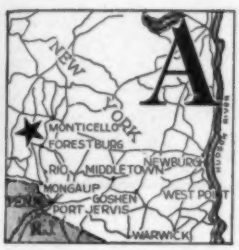
Vol. XVIII
No. II

Contractors and Engineers Monthly

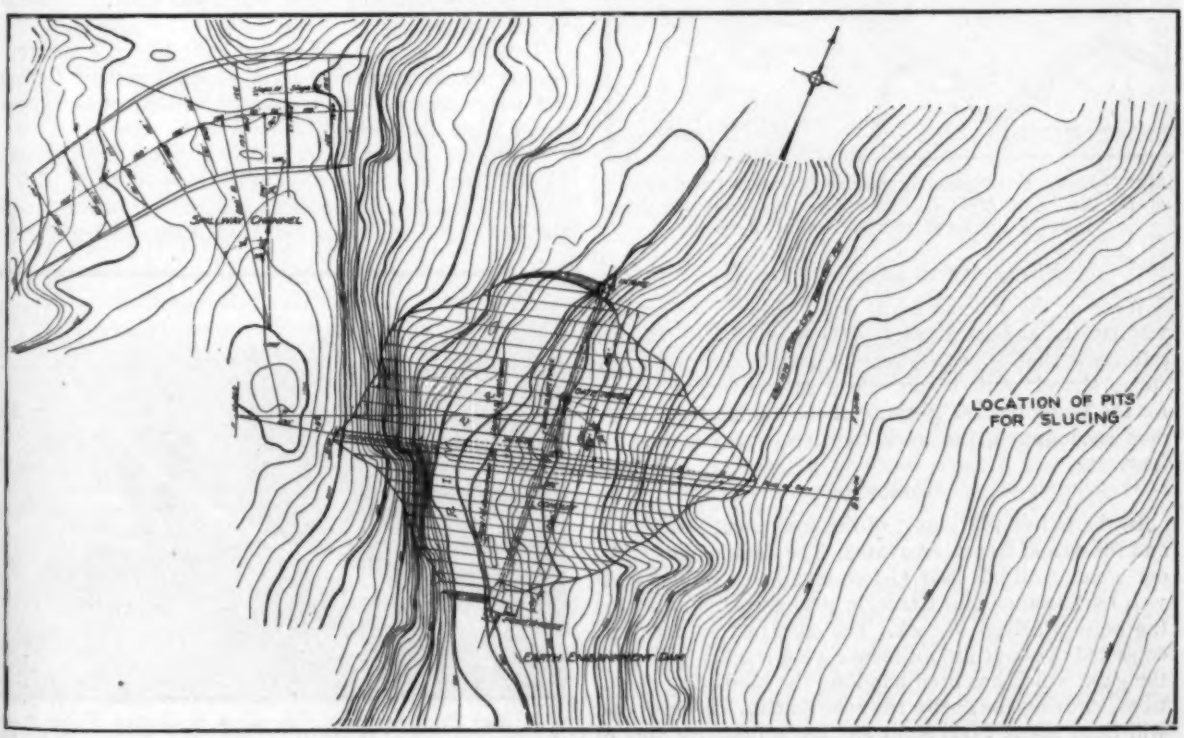
February,
1929

Building a Dam by Hydraulic Sluicing In New York State

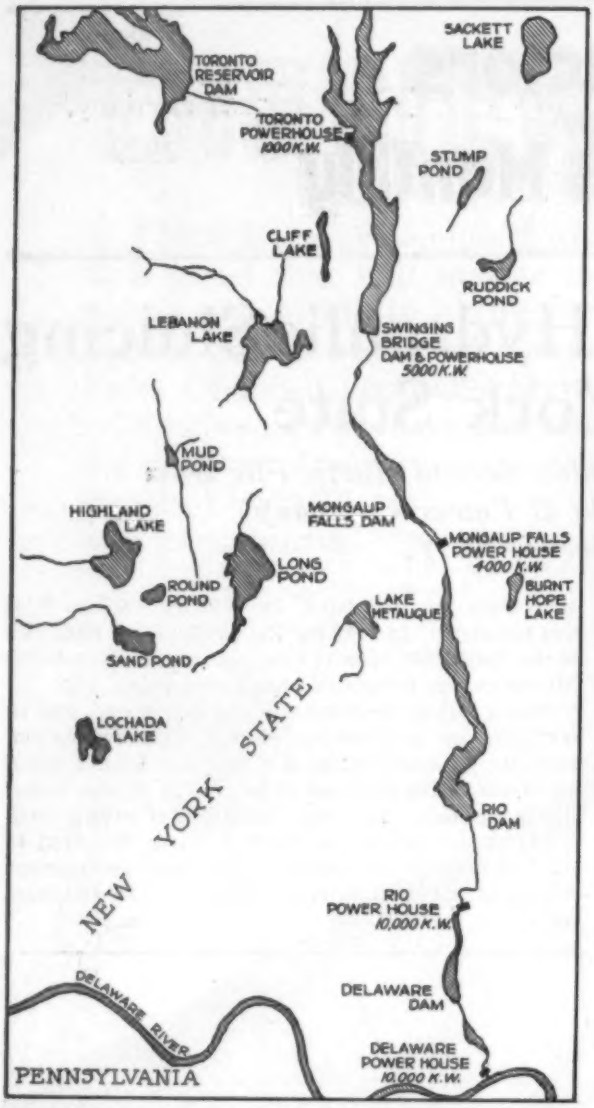
Fred T. Ley & Company Builds Second Earth Fill Dam for the Rockland Light & Power Company Near Monticello, N. Y.



AN extensive hydro-electric development has been under way since 1923 along the Mongaup River which divides Sullivan and Orange Counties, New York, by the Rockland Light & Power Co. The Mongaup River drains about 200 square miles rising on the southwest slope of the Catskill Mountains and flowing south where it enters the Delaware River about five miles from Port Jervis. In 1923, the first of these hydro plants at Mongaup Falls was completed. In 1925 the Toronto Dam was completed. In 1928 the Rio development, described in the April, 1928, issue of CONTRACTORS AND ENGINEERS MONTHLY was completed and in September, 1927, the Swinging Bridge development was begun and will be completed by the latter part of 1929. Future plans contemplate the construction of a pipe line from Toronto Reservoir to the reservoir to be created by the Swinging Bridge dam. This pipe line will also serve a small power station before the water is finally delivered to the Swinging Bridge reservoir. The final development will be at the junction of the Mongaup and Delaware Rivers.



Plan of Swinging Bridge Hydraulic Fill Dam, Showing Location of Spillway and of Sluicing Pits



Map Showing the Location of the Various Power Developments of the Rockland Light & Power Company from the Delaware River North to the Toronto Reservoir

BUILDING THE ROAD INTO THE JOB

Work on the-one and a half mile road into the project was started the latter part of October, 1927. It was estimated that it would require about four weeks of steam shovel work to provide a satisfactory roadway for the heavy trucks. Because of the hardpan and boulders encountered, the work took six weeks instead of four.

CONDUITS

In the fall of 1927, most of the equipment was put in and the cut-off trench excavated. The dam is built without a core wall but uses 35-foot lengths of 14-inch arch web Lackawanna and Carnegie steel sheet piling across the bottom driven to rock. The construction crew has consisted of about 150 men since work started, including the gang which has been handling the lumbering operations, clearing the entire reservoir basin. The reservoir will flood about 1,000 acres and has a drainage area of about 190 square miles.

At the beginning of construction in 1928, the reinforced concrete conduit was started. The conduit is about 700 feet long and was used to divert water during construction. The lower part is 9 feet square and is to be blocked off with concrete when construction is finished. Above the concrete conduit a 10-foot diameter steel pipe is being installed changing to a horseshoe section concrete conduit on the upstream side of the 130-foot reinforced concrete tower located 245 feet from the upstream end of the conduit. Above the steel pipe is a 1½-inch power conduit which will carry the cables

The Dam Site Prepared for Sluicing, Showing the Rock Wall Cut Back to Solid Rock for Fill and Also the Steel Sheet Piling of the Cutoff Wall Which Runs Through the Center of the Dam Longitudinally

to operate the 8-foot diameter motor-operated remote control Dow butterfly valve which will control the flow to the turbine.

Two 24-inch brass valves are built into the concrete closing block to permit draining the reservoir during low water stages if this is found necessary or to bypass water when the turbine is shut down.

Aggregate for the concrete work in the conduit was hauled from a pit about ½-mile below the site of the dam to a washing plant about 100 feet below the toe of the dam. Sand and stone were dumped through a grizzly

The High Pressure Spiral Pipe Used to Convey Water from Pumping Station in the Valley to the Giant Nozzles Under 90 Pounds Pressure at the Nozzle, 200 Feet Above the Pumps

of industrial railway track into the gyrator crusher and thence carried up by a bucket elevator to the washer and through three cylindrical screens to the bins. The oversize was handled to a separate bin and used as needed for building up the road, riprap, etc.

pumps operate through two headers, each controlled by a Crane valve. A priming pump with a 15-horsepower motor delivering 100 gallons per minute is used as needed. Current for driving the pumps is brought in at 33,000 volts on the line and delivered at 2,300 volts to

HYDRAULIC SLUICING OPERATIONS ON THE SWINGING BRIDGE DAM, MONTICELLO, N. Y.

1. The pumping station. 2. One of the 4-inch hydraulic giants in action. 3. A vertical face of hard pan that resisted the hydraulic giants. 4. Head of the upstream and downstream sluice pipes, showing the diversion gates. 5. The steel sluice pipes discharging on the "beach" at the edge of the dam next to the upstream dike. 6. The "beach," a well-graded artificial glacial stratification forming the dam

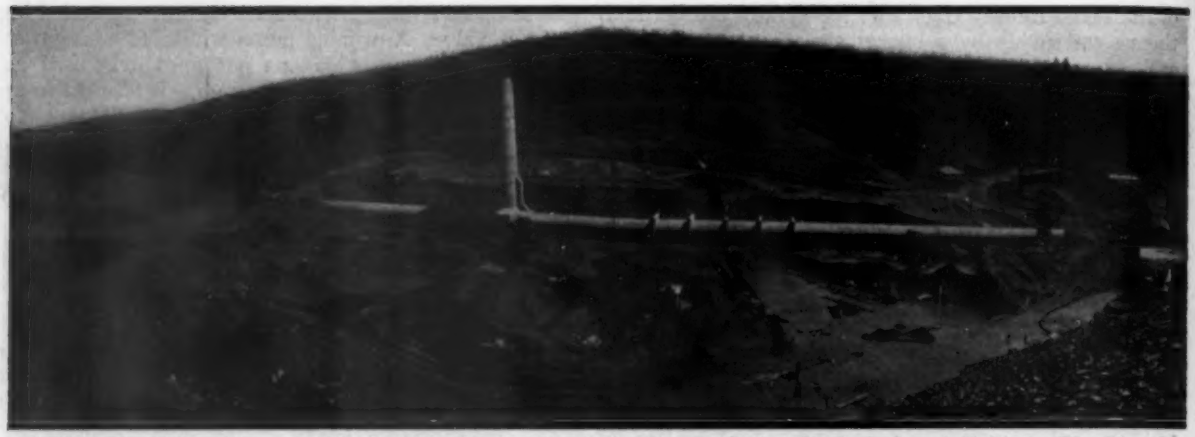
SLUICING OPERATIONS

A pump house was built at the edge of the Mongaup River just below the gravel washing plant and protected by a levee against high water. In the pump house are installed 10 Allis-Chalmers pumps rated at 1,500 gallons per minute at 180-foot head. Two of the pumps are held as spares, 6 of them are equipped with 125-horsepower motors and 4 with 150-horsepower motors. The

the pumps.

Water for sluicing is carried up the hillside at the east end of the dam through two lines of 16-inch Abendroth & Root spiral riveted steel pipe to the pit where it is reduced to 10-inch lines to the 4-inch giants. Sluicing has been continuous since the work was started and the pumps have not been stopped in six months.

The hillside on which sluicing operations were con-



The Swinging Bridge Dam on April 13, 1928, *Showing the Entire Site Ready for the Beginning of Sluicing. The Diversion Tunnel and the Steel Cutoff Are Shown Clearly*

ducted is good glacial drift on the face and at the foot of the hill. It then turns into hardpan and then to sand stone ledge, then into drift with a large number of boulders and finally toward the top of the hill back again into an excellent glacial drift.

Four Abendroth & Root 4-inch hydraulic guns are maintained in the pits at all times with two constantly in operation. Crane 10-inch valves control the pipe lines, permitting shutdowns of two guns at any time that they may be shifted. When guns are shut down a Northwest shovel which has climbed the hillside cuts the new channels and casts out boulders which may slow up the flowing in the sluicing channels

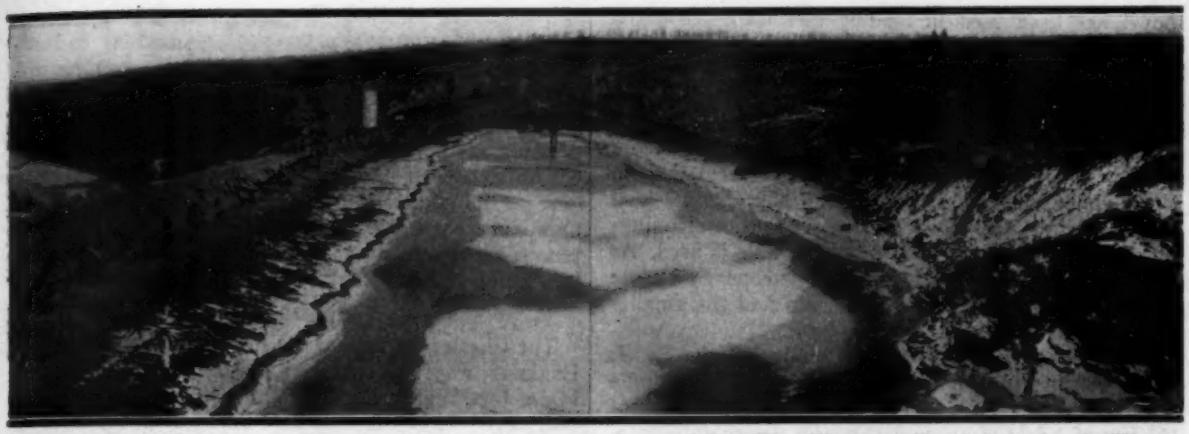
A View of the Top of the Dam on September 13, 1928. *The Framing in the Center is the Skimmer Pipe Which Discharges Into the Diversion Tunnel. This Pipe Regulates the Size and Depth of the Pool by Which the Amount of Fine Core Material is Deposited and Shaped. Sections of Skimmer Pipe Are Shown in the Foreground. These are 18-inch Lock Joint Pipe Made in One-foot Lengths*

and thereby cause the coarser material to be deposited.

A crew of fourteen men are constantly at work shifting pipe and operating the guns. Eight men are used on the dam to shift the sluice pipe, turning it as needed to prevent excessive wear in the invert. The sluicing pipe is American Rolling Mill high grade carbon pipe, but in spite of the high grade it wears through in two weeks unless turned to equalize the erosive action of the glacial drift on the invert.

The sluicing pipes from the pits are carried on trestles built up of trees cut in extending the pit. The maintenance of these trestles is a considerable item in the sluicing operations as they must be continually

The Downstream Face of the Swinging Bridge Dam on September 13, 1928, *Showing Height of the Dam as Deposited by the Sluicing Line. The Pumping Station is Shown in the Lower Left-Hand Corner*



The Swinging Bridge Dam on December 12, 1928, Showing the Dam and Pool When Work was Closed Down for the Winter. The Dam as Shown had been Built up 60 Feet During the 1928 Construction Season

changed in elevation as the height of the dam increases and also must be maintained at an elevation without interference.

One of the accompanying illustrations shows the excellent "beach" formed by the sluiced material as the water drained out. The coarser material was readily deposited near the outside of the dam and material of increasing fineness as it ran into the pool between the two dykes. The skimmer located on the center line of the dam midway across the valley is made of 18-inch Lock Joint concrete tile made up in 1-foot lengths. The turbid water was called off into the conduit and discharged below the dam.

DYKES AND RIPRAP

The dykes for retaining the sluiced material were built up of rocks first from the accumulation at the crusher plant, then from the pit and finally from the excavation for the spillway. All riprap was one-man stone laid up to 3 to 5 feet thick. Usual design would call for riprap not more than 2 feet thick but because of the excess stone available, which had to be disposed of, from the spillway excavation, the riprap on the upstream side was made of excessive thickness. It was hauled from the spillway in 3-ton and 5-ton Mack trucks. When the 5-ton trucks wear out they are replaced with 3-ton trucks which are found much more mobile, easier to handle and equally productive.

The slope of the upstream face of the dam is 3½ to 1 and of the downstream face 2½ to 1. Up to December 1, no riprapping had been done on the downstream face, this work being reserved for winter operations to keep the skeleton organization intact until spring operations could begin.

The dam will contain about 900,000 yards of sluiced material. It measures 815 feet wide at the bottom, 815 feet long at the crest, will be 140 feet high when completed and 25 feet wide at the top.

SPILLWAY

The spillway is located about 750 feet upstream from the dam on the westerly side of the reservoir. It is 250 feet wide and about 650 feet long. The construction of the spillway involves about 140,000 yards of excavation, 40,000 yards of which is rock, which is hauled to the dam for the riprapping described above. A Northwest

Work on the Spillway at the Swinging Bridge Development. At Left, Northwest Shovel Working on Difficult Earth Excavation with Numerous Boulders. At Right, Ingersoll-Rand Tripod Drill Preparing Hole for Blasting Rock Ledge

shovel has been used in loading dirt from the earth excavation to the spillway. Work on this section has been very difficult because of the rock outcrop and boulders.

For drilling, two portable compressors, one Ingersoll-Rand and one Sullivan, are housed just south of the spillway operating a new Ingersoll-Rand tripod drill. A Sullivan submarine drill capable of handling a 4-inch hole to a depth of 30 feet was tried out to save chambering which is necessary when a smaller hole is used. As there was not sufficient air compressor capacity on the job the submarine drill was given up and the smaller drill and chamber used.

The spillway will discharge into Black Lake Brook which returns to the Mongaup River about ½-mile below the power house. The design calls for the use of 125 feet of 5-foot pin-type flashboards designed to automatically release themselves when 2 feet of water passes over them. The remaining length of the spillway will consist of 5 motor-operated gates each 5 feet high by 22 feet 6 inches long. These gates are to be operated to pass freshets when the reservoir is full to prevent the loss of the pin type flashboards, and the 5-foot depth of water behind them. The spillway channel is designed to discharge 23,600 cubic feet per second or 200 cubic feet per second per square mile of drainage area with water 8 feet over the spillway sill or 7 feet below the crest of the earth dam.

POWER HOUSE

The power house is to be about 30 feet wide by 46 feet long by 32 feet 6 inches high from the generator floor to the underside of the roof beams. It will house a 5,000 k. w. generating unit complete with all accessories, switchboard and low tension switching equipment. It will be operated by remote control from the Mongaup Falls Station. The Swinging Bridge Station will be connected with the Mongaup Falls Station by a single circuit 33,000 volt transmission line.

CLOSE OF 1928 CONSTRUCTION SEASON

By the close of the 1928 season operations had advanced to a stage where the guns were working approximately 300 feet above the elevation of the pumps so that they were able to obtain only about 45 pounds pressure at the guns. On each pressure line an Allis-Chalmers booster pump capable of delivering 3,000 gallons per minute was installed, producing a pressure of approximately 100 pounds at the guns. These booster pumps are driven by 150-h.p. motors, and are installed in the line 200 feet above the main pumps.

PERSONNEL

The Charles H. Tenney Co., Frank C. Sargent, Chief Engineer, were the engineers for the work. Charles T. Main, Inc., represented by W. F. Uhl acted as consultant. Fred T. Ley & Co., Inc., Springfield, Mass., were the contractors with Angelo Morris as Superintendent in charge of construction.

Florida to Hold Open Air Road Show

THE first Florida Road Builders Show and Conference is to be held in Jacksonville, Fla., March 19-23, 1929, under the auspices of the Engineering Department and Extension Division of the University of Florida, the State Highway Department, Florida Engineering Society, the Florida Paving Contractors Association, the Jacksonville Chamber of Commerce and groups of material and equipment men.

It is announced that while the show will be known as the Florida Road Builders Show and Conference, it is not the intention of its organizers to limit either visitors or exhibitors to the state of Florida and invitations are being directed to state highway departments, county commissioners, city and county engineers throughout the southeast, covering Florida, Georgia, Alabama, Mississippi, Tennessee, Virginia, North and South Carolina.

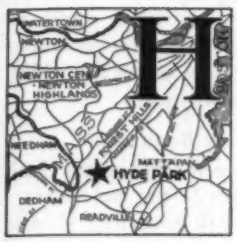
The conference will be a school for road builders with many prominent speakers on subjects of interest to contractors, engineers and public officials handling road contracts. Besides the set exhibits, there will be a demonstration field where road building machinery of all kinds will be put into operation.

A Caterpillar Sixty Operating a Sand and Gravel Plant Owned by Ralph Gobel, Contractor, Furnishing Gravel for Resurfacing State Highways Nos. 79 and 36, Between Sturgis and Rapid City, South Dakota

Breaking a Traffic Bottle Neck Near Boston, Mass.

By W. F. Donovan

Senior Assistant Engineer, Division of Highways, Massachusetts Dept. of Public Works



HIGHWAY traffic on U. S. Route 1 between Boston, Mass., and Providence, R. I., has been steadily increasing, resulting in serious tie-ups. To overcome this an auxilliary outlet has been constructed through Dedham, near the Boston line. In June, 1928, the Division of Highways, Massachusetts State Department of Public Works awarded a contract to Simpson Brothers Corp., Boston, Mass., to construct a double roadway of reinforced concrete, each roadway being 23 feet wide with an 18-foot street railway section in the middle, providing a double track service for street railways between Boston and Dedham. The center section provides for a 9-inch girder rail with a 7-inch concrete slab and a 2-inch bituminous concrete surface. The rail is set ½-inch above the crown of the road, allowing a cross over at any point.

While this project was only ¾-mile long, it called for an expenditure of about $400,000. Of this, $100,000 was for property damage. The original road, being 20 feet wide, made it necessary to move all houses back as the new layout called for an 80-foot roadway. In Boston this same street is 100 feet wide and this ¾-mile section made a bottleneck entering Dedham.

Included in the project were two bridges, one of 20 foot span over a brook and the other of 33-foot span over the New York, New Haven and Hartford Railroad tracks. In addition the contract covered excavation, borrow, a 5- x 4-foot reinforced concrete culvert and a 12-inch gravel foundation graded and rolled in two layers for the concrete pavement. Excavation was started on June 25. The Street Railway cars stopped running over the old bridge on August 7 and resumed over the new structure November 21. A temporary bituminous macadam surface was placed over the deep fills and will be removed next year and concrete substituted.

The work was handled by reconstruction on one side of the highway and new construction for widening on the other. Traffic was maintained through one-half of the project and thence by detour.

Hard Pine Sheeting at North Wing Wall of the Railroad Bridge

View from Street Railway Trestle Looking West, Showing the Old Abutment on the South Side of the Railroad Bridge and the Forms for One Wing Wall

Bridges

The railroad bridge presented a complicated foundation problem as the old bridge was built adjoining a swamp. Test borings showed a hard bottom 16 feet below the railroad tracks. Four large wing walls called for the excavation of about 1,500 cubic yards of peat, necessitating the driving of 20-foot lengths of 3-inch hard pine sheeting.

On the bottom a rubble concrete footing of 1:4:8 mix 16 feet deep, 15 feet wide and from 30 to 70 feet long was poured to 3 feet below the railroad roadbed. On this was poured a 2-foot reinforced concrete footing and a 20-foot abutment wall 18 inches thick with 30-inch reinforced concrete beams set 5-foot on centers. The plant for this work consisted of two steam cranes on excavation and driving sheeting, two gas and one 4-bag steam mixer which handled 2,000 cubic yards of concrete at $18 a yard. About 150 tons of reinforcing steel were used.

The old railroad bridge was 20 feet wide and consisted of a stone abutment and steel girder bridge. The old girders weighed about 20 tons each and were removed by a railroad crane and became the property of the railroad company.

The bridge over Mother Brook had a 20-foot span. A gang of 6 carpenters and 13 laborers took care of forms and concreting. This bridge had 12-inch abutment walls 12 feet high with 22-inch beams, 4 feet 3 inches on centers, 1:2:4 reinforced concrete being used.

WORK OF PUBLIC SERVICE CORPORATIONS

Not a small part of the project was the necessary extension work of the public service corporations. The Eastern Mass. Street Railway Co., expended about $12,000 to erect a timber trestle outside of the limits of the bridge to handle the street cars during construction. The New England Telephone Co., whose long distance truck lines run underground, was required to cut-in temporary duct lines outside of the bridge and, in addition, had to lower the ducts in several places where the grade was cut and to extend manholes for several hundred feet where the grade was raised 6 feet at the new bridge to give a 17-foot clearance above the railroad track. The gas, water and sewer mains were extended. For a time the job presented an animated scene with hundreds of men employed by the different utilities with their machines burrowing among the subsurface structures.

EXCAVATION

The excavation on this job which was handled by the subcontractor, J. F. White Co., of Cambridge, Mass., involved 12,000 cubic yards of earth excavation in the road at 78 cents per cubic yard, 44,000 cubic yards of borrow for raising the grade of the road at 88 cents per cubic yard, and 12,000 cubic yards of gravel for filling in the peat swamp at 98 cents per cubic yard. The borrow was excavated from pits in the vicinity by Erie steam shovels and hauled about a mile to the fill.

At the end of the project the contract called for the filling in of a swamp. The peat ran to a depth of 20 to 25 feet and it was decided to remove it rather than face a 10-year maintenance cost for repairs to the road as it settled over the peat. The peat was removed with a Koehring crane using ¾-yard bucket first, after which a ½-yard bucket was substituted as the heaping buckets were too heavy for the machine with its long boom which was set up on timber cribbing in the swamp. As soon as the swamp was excavated to hard bottom in one section, a raft was set in and the bottom carefully sounded and then back-filled with ordinary borrow, 35 feet wide at the top, 230 feet long and from 20 to 25 feet deep. The removal of the 4,000 cubic yards of peat was done as extra work and cost $1.00 per cubic yard which was considerably under the prices bid which ranged from $1.50 to $2.00 per cubic yard.

CONCRETING OPERATIONS ON ROADWAY

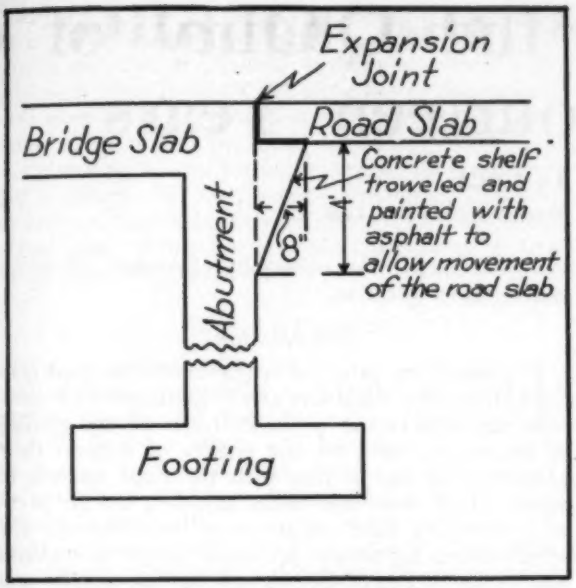
The fine grading for the concrete roadways was done by hand and thoroughly rolled with 12-ton gas rollers.

Coarse aggregate for the road work measured ¼-inch to 2 inches and was purchased by the contractor from the Highland Sand and Gravel Co., West Roxbury, and hauled 3 miles to the job. Dexter cement was shipped to a local dealer and stored along the road each day to take care of the expected run. A 4-bag Multi-Foote paver was used, the aggregate being hauled in batch trucks to the mixer. A 1:2:3½ concrete mixed 1½ minutes was used for the roadway slabs and 4 men spread the concrete in front of the mixer. At intersections which were to be opened to traffic in 3 days a 1:1:1¾ concrete was used, mixed from 3 to 5 minutes. Test cylinders of this concrete showed a strength of 2,700 pounds.

For reinforcing, 42 pounds of ½-inch steel rods were used to the cubic yard of road concrete. These were tied in mats on the job. The first batch of concrete was spread out over the subbase, then the mat laid on the concrete and the surface course poured. As has been used successfully on other Massachusetts jobs, ¾-inch

PAVING OPERATIONS AT DEDHAM, MASS.

1. One-half section of road, showing concrete slab gravel subgrade and street railway ties. 2. Placing bituminous concrete between the rails. 3. Washington Street, Dedham, showing a section complete near East Street



Scheme for Preventing Bumps Between Road Slabs and Bridge Slabs Developed by M. F. Donovan

paper tubes were placed over the expansion ends of the dowels between road slabs.

Elastite ½-inch thick and 9 inches wide was used for all expansion joints. The concrete was finished with a hand screed by four men, followed by hand belting. The day following pouring the concrete was covered with calcium chloride using 2½ pounds to the square yard and the road opened to traffic in 14 days.

BRIDGE BUMPS ELIMINATED

A scheme which the author has developed to eliminate the customary bump at the joints between the road slab and the bridge slab and which has proved most successful consists of the addition of a shelf cast on the abutment wall to support the road slab as illustrated in the accompanying sketch. The concrete shelf is troweled and painted with asphalt to allow the movement of the road slab. The section between the road and bridge slabs has the usual Elastite expansion joint.

PERSONNEL

The contractor on this project was Simpson Brothers, 77 Summer St., Boston, Mass., with C. F. Knowlton as Superintendent and William Powers, Engineer. The work was done under the direction of the Massachusetts Department of Public Works, Division of Highways, of which A. W. Dean is Chief Engineer, R. W. Coburn, Construction Engineer, H. O. Parker, District Engineer and F. A. Chase, Assistant with W. F. Donovan as Resident Engineer.

Hauling with Heavy-Duty Dump Trucks in Highway Grading

LARGE dump wagons drawn by crawler-type tractors have recently come into considerable use with power shovels. The merit of this combination appears to be due to: 1, the crawler type tractor can be operated effectively over a wide range of road conditions such as are found in grading work; 2, it can be maneuvered readily on steep grades over rough or soft ground and among stumps, rocks and other obstructions; 3, it can maintain a relatively high drawbar pull under these conditions and can haul comparatively large loads; 4, the wagons which have been studied by the Division of Management, U. S. Bureau of Public Roads, were strongly constructed and well adapted to operate under severe field conditions and were equipped with a simple and effective dumping mechanism operated in most instances from the driver's seat or from the tractor hauling the wagon.

Under normal working conditions a heavy tractor can draw two of these dump wagons each having a capacity of 5 or 6 cubic yards. If the haul is down very heavy grades, it is sometimes necessary to limit the train to one wagon because at present wagons of this type are not equipped with brakes. The studies indicate that where ground conditions are fair and the road of sufficient width, two wagons can be handled almost as speedily as one, not only in the operating of dumping, turning and maneuvering, but also in the direct haul. The use of two wagons is clearly an advantage if all loading is done at the rear of the shovel instead of the more logical method of loading the vehicles at the side. A one-wagon train can be backed with ease and dispatch, but to back a two-wagon train requires considerable skill and time. A partial solution of this difficulty might be found in the use of a larger shovel. The handicap of a long swing would still remain, but a smaller number of dippers would be required to load each train.

The various operations of turning, dumping and maneuvering are comparatively fast in the hands of a skillful operator. Of the items which make up the time constant in the use of tractor trains, the loading time is the longest. This is inevitable because of the large amount of material carried per load. The loading time is usually from 5 to 7 minutes for a train of two 5-yard wagons. With a standard ¾-yard shovel from 7 to 10 dippers are required to load each wagon. If the cut is narrow so that the turning radius is short, it may be necessary to use the shovel in getting the second wagon into loading position as on short turns it does not follow around perfectly. On wide roads this extra operation is not necessary, nor is it required in loading at the side of the shovel. Any conditions which extend the dipper cycle beyond 20 seconds, such as stiff clay, badly shot rock, stumps, etc., will also extend the loading period, so that digging conditions must be fairly good and ample turning space must be available if a two-wagon train is to be loaded every 6 minutes with the ordinary ¾-yard shovel.

At the dump, layer or end dumping can be used with almost equal facility. With ordinary material the load as it is dumped is spread over a length of some 20 feet. In layer dumping these piles can be spread either by a heavy blade grader or by a bulldozer and the material compacted without serious difficulty under the tractors and wagons as the work progresses. Where this practice is followed the dumping time is almost negligible as the train need hardly come to a full stop in order to make the dump. Dumping the load is often merely a part of the general operation of turning at the dump. Where end dumping is practiced loads are dumped in the same general way as the turn is being made and then a bulldozer or other equipment is used to push the dumped piles over the bank.

Turning is fast. Crawler type tractors can usually work close to the edge of a fill so that a train of two wagons can ordinarily be turned on a 25-foot embankment without backing. Turning time at both the dump and the truck is therefore low. At the shovel the turning is usually done so quickly that the drive-in can be made within a normal dipper cycle. Under fair operating conditions the average time required for turning at the dump, dumping the load and turning again at the shovel should not exceed a total of one minute and under the most adverse conditions, should not exceed a total of 1½ minutes.

Improvement in the Quality of Concrete in Fourteen Years

By George L. Lucas

Division Engineer, Board of Transportation, New York

EW YORK CITY has been building subways almost continually for 28 years. In the beginning of subway construction, the art of making concrete had just reached the end of what might be called the era of dry concrete, relapsing suddenly from virtue into the wet era from which it is only recently recovering.

Throughout the 28 years of construction, no failures of concrete have been noted which might be construed as indicating that concrete is good no matter how made and that the great amount of work spent in its constant investigation has been, in part at least, unnecessary. This is not the case, however, as the duty placed upon concrete has appreciably increased since the old days.

To-day, concrete is used for every possible purpose, both below and above ground. It is the only structural material that is not factory made, which is unfortunate, since it is susceptible to wide variation in quality owing to conditions of manufacture. By comparison there is no structural material subjected to so much abuse in manufacture. If it were possible to manufacture concrete under factory conditions with its adequate machinery and equipment, exact control and a continuing organization, the possibilities seem interesting when we consider by comparison the diverse and heterogeneous equipment and methods used in its manufacture on construction works, the changing working force and intermittent operation of plants which are here to-day and gone to-morrow.

The problem confronting engineers on subway construction in New York City is the production of concrete of uniform quality on all of the work. Considering the great multiplicity of work under construction at one time by a diversity of contractors, the restrictions and limitations caused by environment, heavy traffic and lack of storage space convenient to the works, the general application of methods adapted to single works is difficult. There are now in the course of construction, 35 major works in the New York subways, all using concrete. The situation is complicated by the large number of individual mixing plants operating at one time over a wide territory. At present, there are 12 central mixing plants, 32 portable plants and 1 commercial central mixing plant, operated by 30 separate manufacturers, the contractors. Cement is furnished to contractors by 11 manufacturers, through 21 local dealers and there are 11 plants producing aggregates which are shipped on barges to 11 docks from which they are delivered by distributors to the works in trucks. Twelve contractors handle their aggregates from their own docks. For uniformity of product, the problem is rather peculiar.

Specifications

In general, the principal requirements for good concrete are density, durability and strength and these qualities may be obtained by the kind, quality and grading of aggregates, the kind and quality of cement, their proportioning and mixing with the right amount of water. If all these ingredients and their use are properly controlled, good concrete may be produced. The specifications for cement are quite similar to standard specifications, except for the age increase requirement and tests on neat cement. The fine and coarse aggregate specifications are covered by two short paragraphs which are similar to the usual specifications, requiring good grade material. Broken stone coarse aggregate is limited to hard limestone and trap rock. The real specifications for aggregates consist of 11 closely typewritten pages of standard practice instructions for fine and coarse aggregates, which is not included in the published contract specifications for obvious reasons. These instructions cover the kind, quality, sizes, grading, methods of tests, silt limits, etc. Sands and gravels are required to be washed and it is current practice to wash broken limestone.

The cement and fine and coarse aggregates are inspected and tested at the source of supply or place of manufacture. The cement is delivered in bags which are sealed for identification at the works and the fine and coarse aggregates are identified by a method of following through shipments from the producing plant to the docks and delivery by trucks, so that every last truck load delivered to the job is identified as inspected material. With these precautions in regard to material in effect, their proper use should result in good concrete.

That part of the concrete specifications governing the making and mixing of concrete requires the ingredients to be proportioned by volume, the essential features of which follow in brief:

Proportion—1 part cement, 2 parts fine aggregate, 4 parts coarse aggregate.

Unit of Volume—⅞ of a cubic foot, the volume fixed for one bag of Portland cement containing 94 pounds net.

Water—The maximum amount of water permitted including moisture in the aggregates is 6¼ gallons to one bag of cement.

Measuring Devices—Exact measuring devices are required for aggregates and all measures must be struck.

Measuring Fine Aggregate—Measurement of fine aggregate is by inundation, or by weight based on a pre-determined volume.

All mixers now in use are of the rotary type and vary in size from a 1-bag batch to a 7-bag batch, except in one case, at a central mixing plant where a 20-bag batch mixer is used. The capacities of these mixers vary from 1/6-cubic yard to 3 cubic yards. The minimum length of time permitted for mixing is 1 minute for mixers up to and including 1-cubic yard capacity, and 2 minutes for the 3-cubic yard mixer. Portable mixers are located directly on the works and central mixing plants either on the site of the works or at a nearby convenient location.

HANDLING CONCRETE

When portable mixers are used, the concrete is generally chuted directly from the mixer to the forms underneath; in the case of central mixing plants concrete is hauled in motor trucks and deposited directly from the trucks to forms through chutes. In the case of one central mixing plant from which the haul is long, concrete is transported by motor trucks on which are mounted drums which revolve in transit to preserve workability. The hauling of concrete has necessitated regulations by rules limiting the time between mixing and depositing. For large building construction such as shops, towers and long chutes are sometimes used for conveying concrete. For the lining of rock and subaqueous tunnels, the pneumatic method is frequently used, principally for roof-arch concrete. These are the most common methods of transporting concrete on subway works.

TESTING

The concrete is tested daily by making 8 x 16-inch cylinder specimens, 9 to a set, for testing at 7, 28- and 90-day periods. The samples for these specimens are taken either from the forms immediately after the deposition of concrete, or as it is being deposited in the forms. The work is performed by a crew of 5 men under the direction of an engineer. The equipment consists of a motor truck, accurate measuring and weighing devices, molds, etc. At the time of making the specimens, this crew also checks up the measuring devices and the equipment of the mixing plant producing the concrete. At least one set of specimens every month is made for each and every mixing plant. In special cases, a series of tests may be made on one plant to correct irregularities.

These tests along with collateral tests and investigations of concrete in the laboratory, have developed the factors contributing toward good concrete. They have been of great value in standardizing its manufacture and the production of concrete of more uniform quality on these extensive works. Very shortly after their introduction improvement became apparent as the field engineers were furnished a definite measure of quality.

PROGRESS MADE

This form of testing and control has been in operation fifteen years, beginning when it was the general practice to make very wet mixes. The accompanying sketch shows graphically the progressive improvement in quality of New York subway concrete during this period. Hidden in this diagram is recorded an interesting history, as each increase in strength representing improved quality is the result of an individual attack on the problem.

In the year 1914, concrete in general produced by the many contractors was exceedingly wet and common practice irregular, resulting in low strengths. Steps were taken in the year 1915 to reduce the amount of water used in mixtures and to improve methods of mixing and placing, with the result that an increase in strength or quality of 11½ per cent was effected in one year for 28-day specimens. A continued effort throughout that year and the succeeding year, 1916, resulted in a still further improvement, represented by an increase in 1916 of 18 per cent over the 1914 strengths for 28-day specimens.

In the next year, 1917, not much progress was made but no ground was lost and from the information gathered on the works, it appeared time to attack the problem from another angle. It had been noted that the measuring devices were many in kind and some of them obviously inaccurate although in common use in the construction industry.

In the year 1918, the calibration of devices for measuring fine and coarse aggregates was begun and imme-

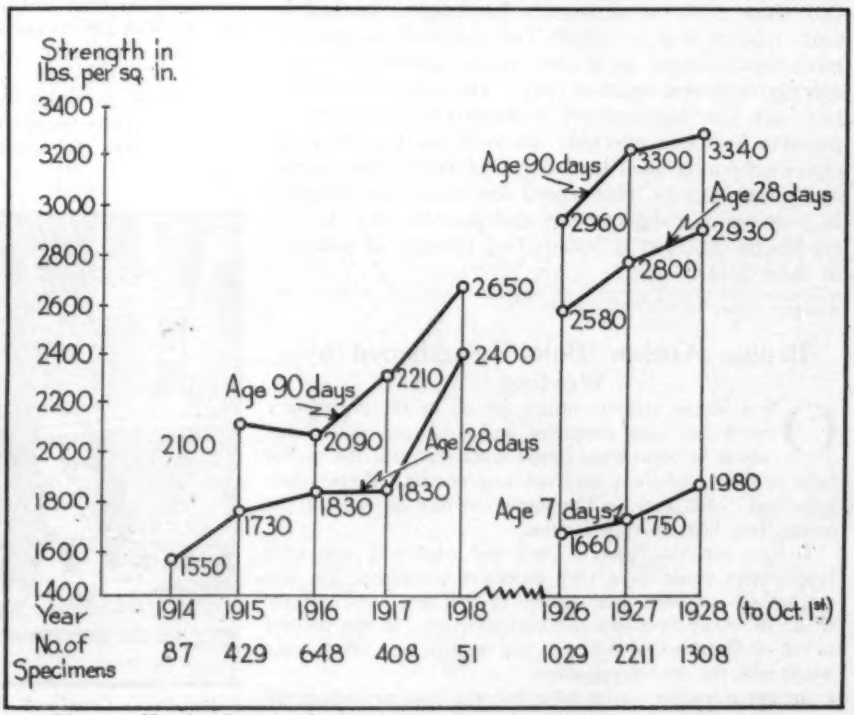


Diagram Showing Increase in Strength of Concrete Used in New York Subway Construction from 1914 *to* 1928

diately there were disclosed wide discrepancies and consequently great variation in the unit volumes used at the many mixing plants. Illustrating the inaccuracies in measuring, a calibration at one plant showed the actual proportion to be 1:2:5½, another 1:3:5 and another 1:1.7:3.8, whereas the specifications called for a proportion of 1:2:4. The specifications in force in those days required the measuring of aggregates as cast loose in a measuring box. During that year, measuring devices were more carefully controlled and concrete strengths rose rapidly, so that the average for the year at 28 days became 2,400 pounds, an increase of approximately 55 per cent in strengths over the 1914 period.

A hiatus now appears in the curves from 1919 to 1925, a period when comparatively little construction work was under way, when concrete testing was intermittent and not continuous enough to yield averages that could be considered reliable. During this period, however, the study of concrete continued, including an experiment on the works, with a contractor's plant to determine the effect of exact measuring of ingredients, leading to a modification of the specifications, adopted in 1921, requiring exact measuring devices for both fine and coarse aggregates and with the measures struck. Testing in volume began again in 1926, a period when heavy construction was well under way and the effect of the requirements for exact measuring is reflected in the increase in strength of 66½ per cent for the 28-day specimens over the 1914 strengths.

In 1926 a vigorous campaign for the exact control of water began, the effect of which was a further improvement, illustrated by an increase in strengths in 28-day specimens at the present time of 89 per cent over the 1914 strengths.

Now the astounding feature of this record is the fact that since 1914 the aggregates have been identical in kind, quality and grading. The specified proportions have been changed in a very minor degree for coarse aggregates in one instance only. The cement specifications are identical and yet a decided improvement in concrete has been effected. In 1914 the general principles governing good concrete were fairly well known and promulgated. This record illustrates the difficulty in overcoming fixed customs and practice and the obstacles encountered in attempting reforms in advance of their time.

ACKNOWLEDGMENT.—From a paper read before the New York Section, American Society of Civil Engineers.

Bridge Anchor Bolts Lengthened by Welding

ON a recent highway bridge job all of the preliminary work had been completed and steel construction was about to begin when it was discovered that the anchor bolts in the foundations were not long enough. These 5-foot bolts had been sunk in the seven concrete footings of the bridge, four bolts to each footing.

To tear out the concrete piers and pour new ones with longer bolts would be a very expensive procedure. To core out around the bolts deep enough to sink new ones properly would be nearly as costly and unsatisfactory. It was decided to cut off the threaded bolt ends and weld on new lengths that would give the desired extension.

An oxy-acetylene cutting blowpipe was used to remove the threaded portion of each bolt. Then the remaining portion of each bolt was beveled with the cutting blowpipe to 45 degrees and the same was done on the unthreaded end of each extension piece. The final step was to weld the extensions to the stumps. In doing this a reinforcement of ⅛-inch was built up around the joint. This insured entirely satisfactory strength and did not interfere with the function of the bolts since the holes in the column base were somewhat oversize. One welder and a helper did the entire job in three days and then the bridge construction went ahead on schedule.

Welding Extension Bolts to the Stumps of Old Bolts With an Oxy-Acetylene Torch

Paver Kept Level by Wedge-Shaped Platform on Steep Grade

THE steep grades on the side hill streets of San Francisco are proverbial. Those who have not seen them have at least heard of them. Many of these steep streets are now being paved with concrete, using a paver with crawler tracks to mix the concrete.

Before the use of this type of paver, it was necessary to employ motor trucks to tow the paver up and down the steep grades. At other times it was necessary to place the mixer at the top of the grade and run the concrete into place by wooden chutes. With the crawler tracks the present pavers go up and down any of the steep streets, operating successfully on grades as high as 22 per cent.

When the paver has reached the point where it is to be used, the crawler tracks are run onto a heavy triangular piece of timber until the machine is level at which time mixing is begun.

A Multifoote Crawler Type Paver on a Steep Grade in San Francisco Ready to Mix After Running Onto a Wedge-Shaped Timber to Insure a Level Base

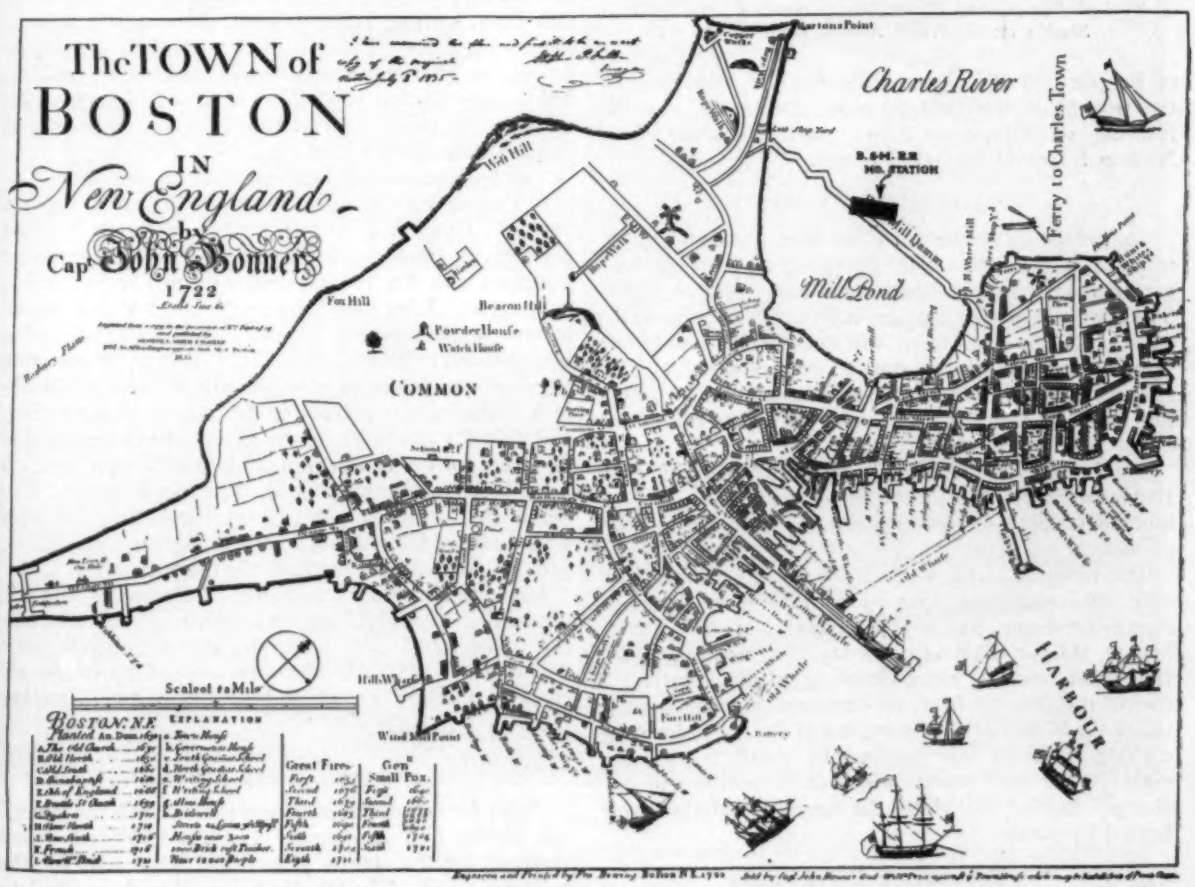
Foundation Conditions and Methods of Construction for the New North Station Development at Boston

By Wallace E. Belcher

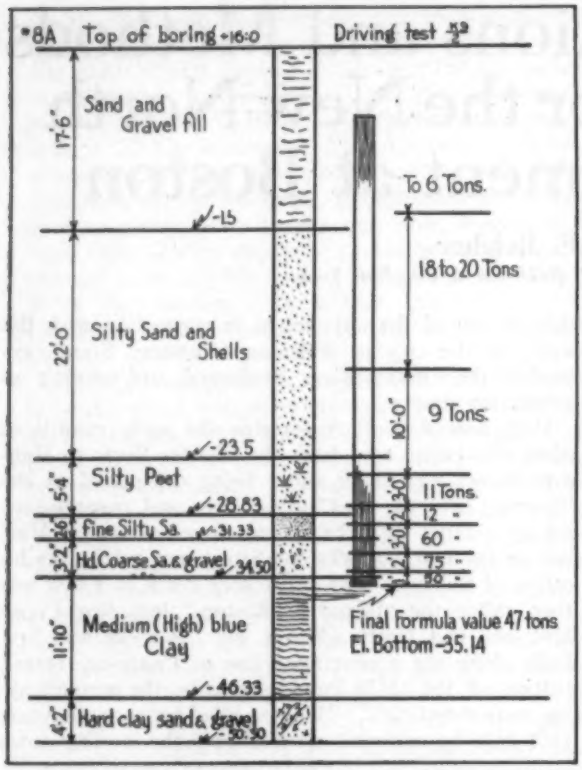
Supervising Engineer, Dwight P. Robinson & Co., New York

THE new North Station of the Boston and Maine Railroad was dedicated on November 14 at a dinner given in the east end of the new waiting room, by the officials of the Boston and Maine Railroad. The station occupies the site of the former North Station which was constructed in 1893, and combines the passenger service originally cared for by four terminals, the Boston and Maine, the Boston and Lowell, the New England, and the Fitchburg Railroads. The monumental character of the terminal improvements completed and under way marks the commencement of a new era in the character of building construction in this section of the city, taken in connection with the work of the city in widening Causeway Street, extending the Charles River Boulevard, and opening up connecting streets.

It is now difficult to imagine the early conditions when this entire area from the Charles River to Hanover Street was under water being designated as the "North Cove" of the Charles River and communicating by a canal with the "Great Cove" of Boston Harbor on the east. Blackstone Street now marks the location of this canal, the entire area north of which was then called the "Island of Boston," including Copps Hill, the Old North Church, etc. A dyke was first built along the approximate line of Causeway Street, cutting off the "Mill Pond" shown on the accompanying map, dated 1722. This was filled between the years 1807-1830 by materials secured from the leveling down



A Map of the Town of Boston Made in 1722, Showing the Location of the New North Station in Relation to the Older Landmarks



A Typical Pile Record Made During the Soil and Driving Studies on the North Station Development

of Beacon Hill and Copps Hill. On this filled ground the present station and terminal tracks are located, fronting on Causeway Street, and extending from Nashua Street to Haverhill Street.

WRECKING OLD STATION

The wrecking of the old train shed was handled by means of a locomotive crane operating from the passenger terminal tracks between rush hours and at night. The wrecking of the station buildings was necessarily done largely by hand labor, the work being done piecemeal as sections of the station were released by the railroad company and in such a manner as not to interfere with the use of the station or jeopardize the safety of the public.

The building of a complete temporary concourse of timber work for the protection of the public, and of numerous sheltered passageways was incidental to the permanent construction.

The removal of the excavation and old foundations and canal walls was done by an Erie shovel-crane, a Northwest crane, and a P & H crane, operating grab bucket, skip or chain as necessary. On account of the tide water reaching elevation 11 or within less than 5 feet of the finished floor, no basement was constructed under the building. The pumping of the water from individual footings was handled by small units using eight Parker mud pumps with 3-inch suction and discharge. During the winter the concrete materials were heated by steam.

FOUNDATION DIFFICULTIES

Exploration for foundations disclosed the depth of the fill, the underlying harbor bottom, and the bearing strata underneath, shown on the accompanying typical boring and pile record. The wood piles for the original station were carried entirely in the material indicated as sandy silt. The heavier loads of the present building are carried by concrete piles which penetrate the upper layers and reach well into the hard gravel or clay strata. An intermediate layer of black peaty soil was found just above the bearing clay strata which it was necessary to penetrate. It will be noted from the typical record that the pile driving was somewhat less difficult as this layer was being reached as compared to higher or lower positions of the pile. After passing this layer, resistance mounted rapidly, the average length of pile being about 50 feet below the original ground level.

The old sea walls and other underground obstructions greatly increased foundation difficulties. The amount of rock excavated, for instance, above elevation 9 being 516 cubic yards as compared to 216 cubic yards of earth. The wooden piles under the 1893 station were found to be in excellent shape, cut-off being about elevation 7. It was not possible to pull these piles, so that the new piles had to be driven between them or along side in many cases, necessitating special footing designs to meet the conditions. In one or two cases this was impossible and the old piles were used at a very much reduced value.

The concrete piles are of the Simplex type, 16 inches in diameter, carrying an allowable maximum load of 30 tons each, without reinforcement, the concrete proportions being 1:2:4. Two full size loading tests were made on regular Portland Cement piles selected at random. These tests showed settlement of about ⅛ inch under a load of 30 tons, ¼ inch under a load of 50 tons, and ⅜ inch under a load of 60 tons.

The foundation work was handled by the New England Foundation Co., using three pile drivers of its own design. These had 65-foot timber leads on a wood platform mounted on steel rollers. The drivers were equipped with 9 x 10-inch double-drum Lambert hoisting engines. Piles were driven with No. 1 Vulcan steam hammers, the standard length of the steel drive casing being 40 feet. Where piles over 40 feet in length were required a follower pipe was used. A steel tip of 18-inch diameter was placed on the bottom of the casing, and this tip remained in the ground when casing was removed. Two concrete mixing plants were set up using No. 7 Koehring mixers. The mixer dumped into Easton platform cars which were handled to the piles on 24-inch industrial track, hoisted by the pile driver, and the concrete poured into the drive casing.

Foundation work was started on December 5, 1927, proceeding as rapidly as the removing of the old station permitted. The total number of concrete piles driven was 1,518. All piles were capped by reinforced concrete footings, on which billets were set to receive the columns.

STRUCTURAL STEEL ERECTION

Order for structural steel was placed with the American Bridge Co., on January 1, 1928, 1,200 tons being required for the station proper and 2,700 tons for the coliseum above. The job divided itself horizontally into two parts. The station portion being 22 feet in height

and complete in itself was carried on in advance of the coliseum work above this level.

The structural steel was erected by the George F. Watts Corp., which used guy derricks and stiff legs of its own manufacture. The station portion was erected with a steel stiff leg traveller with a 105-foot boom operating on the arena floor deck level working westward from the Haverhill Street, or easterly end.

The concrete slab for the arena floor was placed before erecting the steel for the coliseum. This erection was handled by two guy derricks, with ball-bearing foot block and spider having a 125-foot mast and a 116-foot

PROGRESS PHOTOGRAPHS OF THE CONSTRUCTION OF THE NEW NORTH STATION AND ARENA IN BOSTON, MASSACHUSETTS

1. *General view of the site on March* 15, 1928, *showing the temporary concourse at the left and the temporary passageway to Causeway Street. Excavating, concrete mixing and pile driving are shown in the foreground and steel erection in the background.* 2. *Driving piles through hatchings in the roof of the temporary concourse.* 3. *Concreting the arena floor, April* 16, 1928. 4. *Steel framing and forms at the east end of the Coliseum, August* 8, 1928. 5. *Steel erection approaching completion, August* 15, 1928. 6. *View from the northeast September* 17, 1928

Placing Acoustex Slabs on Steel Tees to Form the Underside of the Roof Slabs

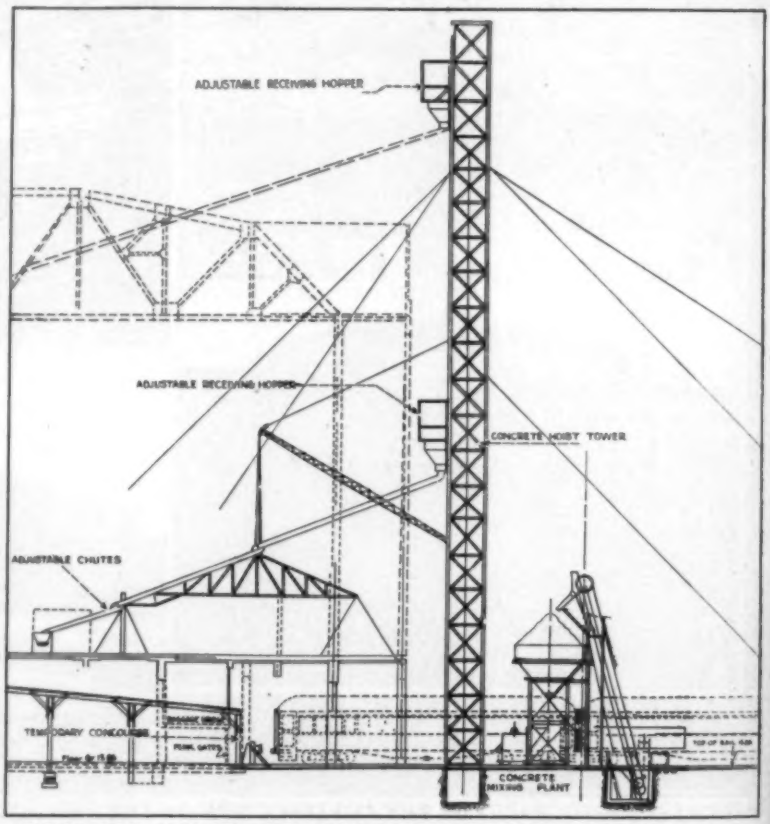
boom. Hoisting engines used were Mead-Morrison and Stroudsburg with standard erection equipment. Each of these derricks had a capacity for lifting 25 feet at an 85-foot radius. After the first roof construction was in place, two 3-ton wood frame jinnywinks were set up on the roof for handling the smaller pieces.

As the field rivets were ⅞-inch and 1-inch diameter and the work was in a rush, the compressed air demand was heavy. A Chicago-Pneumatic compressor was used driven by a 75 h.p. Continental gasoline motor, mounted together, and operated on the arena floor level. The heavy trusses weighing about 40 tons each were assembled and riveted complete on the floor in a vertical position. They were then lifted into place using the two derricks simultaneously.

CONCRETING PLANT

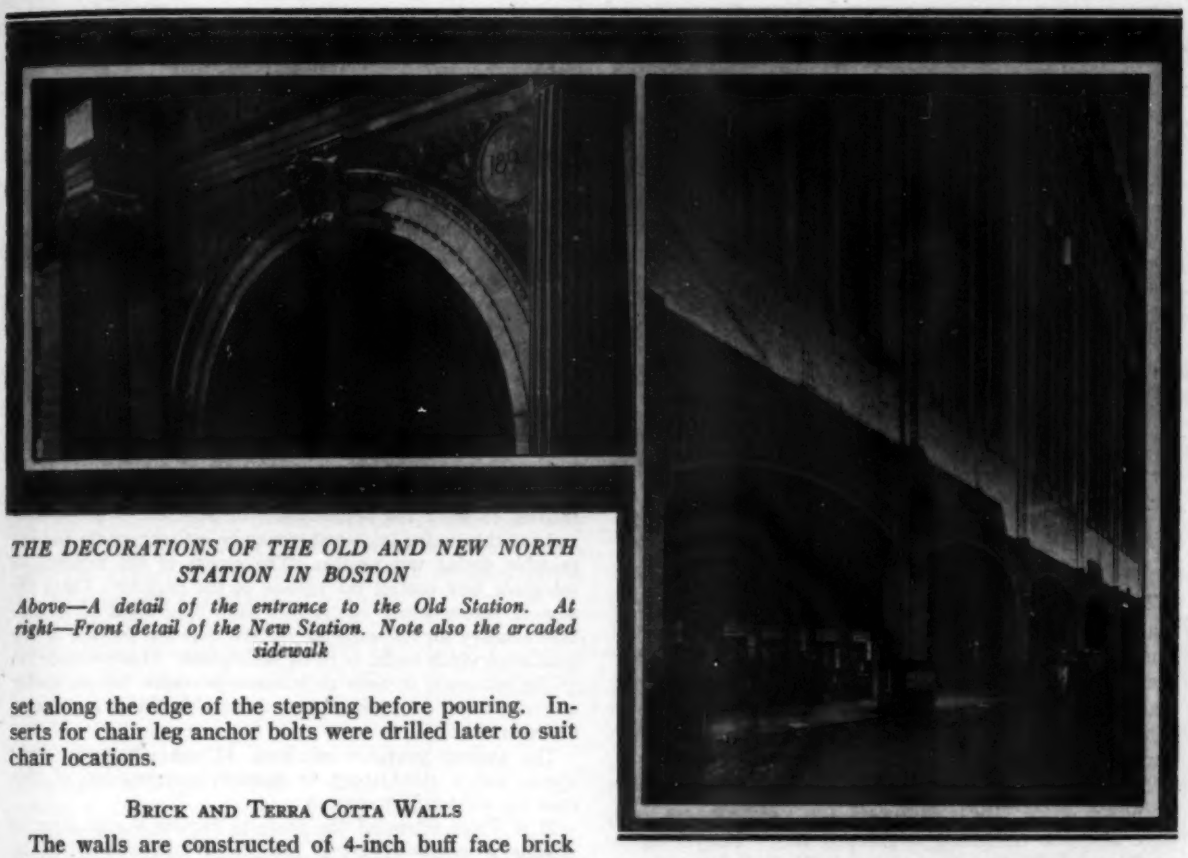
The mixing and handling of necessary portland cement concrete was one of the principal problems of the construction work as there were about 15,000 cubic yards of concrete and 400 tons of reinforcement required. All of the ramps, the floors, and the stadium and balcony steppings were of reinforced concrete. In order to deliver concrete materials in car loads near the center of the building, arrangements were made with the Boston and Maine Railroad to permit the use of two of the passenger terminal tracks, the location of the tower in relation to the building being shown on the accompanying diagram. The width of the space available for the concrete plant was only 20 feet, the width of the passenger platform between tracks. In this space were laid out the sand elevator and bin on one side and gravel elevator and bin on the other side, cement being delivered in a central rollway. The material was dumped from hopper bottom cars or shoveled into the feeding hoppers of bucket elevators leading to the storage bins, and from there descended by gravity through the bins, batching and mixing equipment into the skip hoist. The bucket elevators were 42 feet in height, with a capacity of 50 tons per hour equipped with 20 h.p. motors, and manufactured by the Good Roads Machinery Co. The sand and gravel bin had a capacity of 72 tons, the bin and batchers being Blaw-Knox standard types. A 1-yard Ransome concrete mixer with 20 h.p. motor, batch hopper and automatic water measuring tank took care of the mixing of the concrete, and had a capacity of 40 cubic yards per hour. Concrete was received in a 1-cubic yard skip at the bottom of the Insley steel concrete tower. This tower was equipped with the usual slide frame, steel boom, and spouting chutes, and delivered to the floor hoppers at any point on the job. For operating the skip a double drum Lambert hoisting engine was used.

The concrete forming the arena floor slab was placed as a working floor as soon as the station steel had been erected. An interval of time was necessary after placing this slab, in order to erect the structural steel of the superstructure before the stadium and balcony steppings could be placed. The rough slab meanwhile formed a roof over the station underneath and took the place of the temporary canopies and shelters which were necessary up to that point in the construction. For the forms of the concrete steppings, removable panels were laid out so that they could be moved along as the work progressed. The concrete slabs and risers were only 4 inches in thickness and were thoroughly reinforced. All of the inserts for the pipe railings were



LAYOUT OF CONCRETING PLANT OF THE NORTH STATION ARENA PROJECT IN BOSTON

The mixing plant is shown located between two passenger train loading tracks closely adjacent to the temporary concourse which was used throughout the work to handle passenger traffic



THE DECORATIONS OF THE OLD AND NEW NORTH STATION IN BOSTON

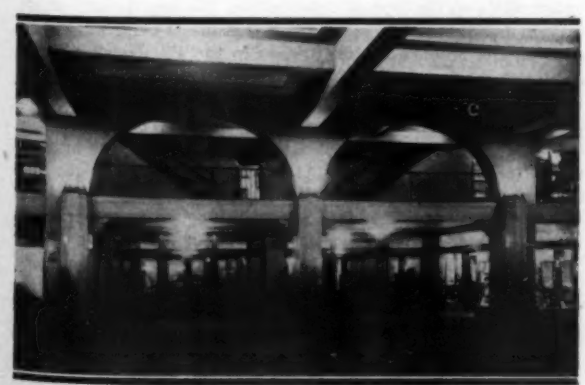
Above—A detail of the entrance to the Old Station. At right—Front detail of the New Station. Note also the arcaded sidewalk

set along the edge of the stepping before pouring. Inserts for chair leg anchor bolts were drilled later to suit chair locations.

BRICK AND TERRA COTTA WALLS

The walls are constructed of 4-inch buff face brick with 8 inches of interlocking hollow terra-cotta tile backing. The hoisting of the masonry materials was taken care of by a single tower hoist at the northeast corner, a single tower hoist at the west end and a double tower hoist on the Causeway Street front, locations being shown on the diagram. The erection of the walls was carried out as usual from patent scaffolding wherever possible. Except for the granite base course, the trim is artificial stone so that in choice of materials as well as in design this station marks a radical departure from the former Boston and Maine and Boston and Lowell stations. These stations had a large amount of cut granite ornament, the cost of which to-day would be prohibitive.

One of the remarkable features of the coliseum is the roof construction, which has on the underside a sound absorbing layer of "Acoustex." The illustration shows the ease with which this material was erected taking the place of the usual forms required for a poured-in-place gypsum roof, such as was used here. With this material there was practically no leakage of gypsum on the work below, in fact the structural steel frame work of the roof was painted in advance of placing the roof, saving a large item of cost for scaffolding.



An Interior Detail of the Station

USE OF STRUCTURE AS ARENA

The new railroad ticket offices were put in use in August, 1928, the formal opening of the station being November 14, 1928, and of the coliseum November 17, 1928. The coliseum, known as the Boston Garden, has been leased for a long period to the Boston Madison Square Garden Corp. The arena and hockey rink are identical in size with the Madison Square Garden in New York. The seating capacity is approximately 18,000 for boxing matches and 14,500 for hockey. From present indications the patronage of the Boston Garden will be very heavy as there is a large sports loving element in the city and suburbs to the northward. The arena will be used for boxing matches, hockey games, public skating, dances, bicycle races, foot races and other athletic events, for circuses and shows of various kinds and for concerts and assemblies. The amplifier installed above the center of the arena easily fills the entire auditorium, reproducing with clear tones.

The entire finish of the station has been treated carefully to obtain a maximum richness of design and a pleasing architectural effect. By the erection of this structure the Boston and Maine Railroad has added tremendously to the assets and resources of the City of Boston.

Interior of the New Boston Madison Square Arena as Set Up for a Boxing Match

PERSONNEL

The entire Terminal development of the Boston and Maine Railroad is in charge of W. J. Backes, Chief Engineer, assisted by F. C. Shepherd, Consulting Engineer. Fellheimer and Wagner of New York were the architects for the railroad station and the exterior treatment of the building, while Funk & Wilcox of Boston were architects for the coliseum.

The construction work was carried out by Dwight P. Robinson & Co., Inc., Engineers and Constructors, who were also the designing engineers, B. S. Thayer being superintendent of construction and W. E. Belcher supervising engineer.

Ambiguous Specifications Cause Undue Hardships

IN drafting specifications it is generally considered that the interest of the State or awarding body is the primary consideration and that the chief objective of specifications is to protect the State and guarantee the quality of construction. Due to the fact that specifications are drawn by engineers representing the awarding body, usually even without consultation with contractors who will perform work under the specifications, it is to be expected that the provisions under which construction is to be performed will be, at best, "one-sided" in their protection. In view of the care which has always been exercised in protecting the interest of the State in the matter of specifications, should not the same care be taken to protect the individual contractor who may be the successful bidder on any project covered by the specifications? Unquestionably the State is fully protected, because it draws its own specifications, holds the contractor responsible for methods, holds him responsible for results, and the state engineer is the final arbiter in interpreting the specifications, and is usually the final arbiter in questions of dispute. The only protection offered the contractor under such a system is the theory that he should understand the specifications thoroughly before he bids, should recognize that unlimited powers of discretion are given to the engineer in charge of the work, *and should bid accordingly*. "Let the buyer beware" must be always uppermost in the minds of bidders. Whether justified or not, this is the system under which contractors must necessarily contract to perform state work. In spite of this policy, it is felt that state engineers can do much towards rendering this condition less hazardous for both State and contractor by eliminating elastic clauses in specifications and insisting on clear-cut provisions wherever possible. Many cases of dispute find their way into the Court of Claims which could be guarded against when specifications are written. The following will prove a case at hand which is close to more than one contractor whose contract provides for maintaining traffic during construction operations.

Item 77 of the specifications of the New York State Division of Highways, Department of Public Works, provides in part:

"The Contractor shall protect the new pavement from damage due to traffic and must erect suitable barricades, guide signs, red lights, etc., and provide necessary watchmen and signalmen. Where the width of the usable roadway is insufficient to accommodate two-way traffic, turnouts at least 50 feet long and not more than 300 feet apart shall be built and kept in a *passable* condition by the Contractor. The Contractor *shall keep the roadway in a safe, passable condition for traffic at all times,*" etc.

The term "in a safe, passable condition for traffic" has been subject to a variety of interpretations by different engineers, with a consequent hardship in many cases on contractors. What is considered as safe and passable by some engineers may fail entirely to meet the requirements of another. What is safe and passable during fair weather may be entirely unsafe and yet passable during wet weather. The nature of the material in sub-grade may control the opinion of the engineer. Cases are now on record where contractors have been required to provide a heavy gravel surfacing for the unpaved portion of the road over which traffic is to be maintained. Muddy condition of the sub-grade in such an instance penalizes the contractor severely, where an engineer regards such condition as "unsafe or impassable."

The present provision of Item 77 are admittedly very vague, and a satisfactory or definite interpretation of this item has not yet been arrived at.

If it is the intent of the State to require a contractor to provide a temporary gravel road for traffic, this should be made clear in the specifications and ample provision should be made in the engineer's estimate for the expense involved. It is highy unfair to require a contractor to furnish gravel surfacing when neither the engineer's estimate nor the bid price had anticipated that expense.

The Low Bidder.

The Bridges of Pittsburgh

UNDER this title a 113-page illustrated book was published at the end of 1928 by the Cramer Printing & Publishing Co., Pittsburgh, Pa. The authors of the book are Joseph White, engineer, Department of Public Works, Allegheny County, Pa., and M. W. von Bernewitz, mining and metallurgical engineer, United States Bureau of Mines. Mr. von Bernewitz was the author of an article on this subject which appeared in CONTRACTORS AND ENGINEERS MONTHLY for April, 1927.

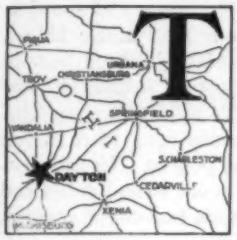
The book, which is replete with illustrations, discusses the types of bridges, their architectural features, the influence of automobiles on the type of construction, the negotiations necessary in building a bridge over a navigable stream, interesting data on the absence of toll bridges in the Pittsburgh district, disastrous bridge fires of the past and vibration in bridges. Following this is a pictorial review of the bridges of Pittsburgh as seen from a river steamer. The closing chapters of the book are devoted to specific descriptions of the railroad bridges, street railway bridges, hot metal bridges and the weight and costs of the various structures.

The floating of the 6th Street bridge of Pittsburgh to Coraopolis, described in the March, 1928, issue of CONTRACTORS AND ENGINEERS MONTHLY, makes up a very interesting chapter. This is followed by descriptions of other older bridges and a chapter on Pittsburgh—a Self-contained Bridge Building District.

Copies of this bound volume may be secured from the publishers for $5.00 each.

Sewage Treatment Plant Construction at Dayton, Ohio

By M. W. Tatlock
Resident Engineer



THE bids for the construction of the sewage treatment plant and the installation of equipment were opened at 12 o'clock noon, October 31, 1927. A tabulation of these bids revealed that the E. H. Latham Co., of Columbus, Ohio, was the low bidder. A thorough investigation of past work done by the company and of its financial responsibility was made by the city officials. When this investigation left no question as to the company's responsibility a contract was entered into on January 4, 1928, calling for the completion of the work in 465 days, at a total estimated cost of $677,928.06.

The contract covered the erection of an administration building with chemical and bacteriological laboratories, a skimming detritus plant including settling skimming tanks, grit chambers, screens and screenings, incinerator, six two-story Imhoff tanks, and covered sludge beds. The installation of special equipment, placing of connecting conduits and all sludge lines, building of drives and walks and the landscaping of the site were also included. The City furnished to the contractor the Dorr clarifiers and screens, the sludge ejectors, the screenings press, the Link-Belt grit cleaning equipment, the cast iron pipe, sluice gates, gate valves and shear gates, Yeomans detritus and sump pumps, Plymouth gasoline locomotive and Koppel industrial cars.

Quantities

The engineers, Metcalf and Eddy, estimated some of the important items as follows: excavation 65,800 yards, concrete masonry 14,000 yards, reinforcing bars 1,340 tons, 7,300 feet cast iron pipe four inches or larger, 9,300 feet of wrought iron pipe, 9,250 feet industrial track and eleven glass-overs for sludge beds.

Excavation

Preliminary borings at the plant site showed approximately 2½ feet of loam and top soil underlaid with a bed of sand and gravel extending deeper than the bottom of the Imhoff Tanks. This loam and top soil, totaling 14,000 yards, was excavated with gasoline shovels and stored conveniently for use in finish grading. This excavation as well as that for pipe lines and conduits was done under a sub-contract which covered replacement in back fills or embankments. The excavation of gravel and sand for the Imhoff tanks has already been described in the September issue of Contractors and Engineers Monthly, page 141.

Plant Layout

During the time that the excavation was being done,

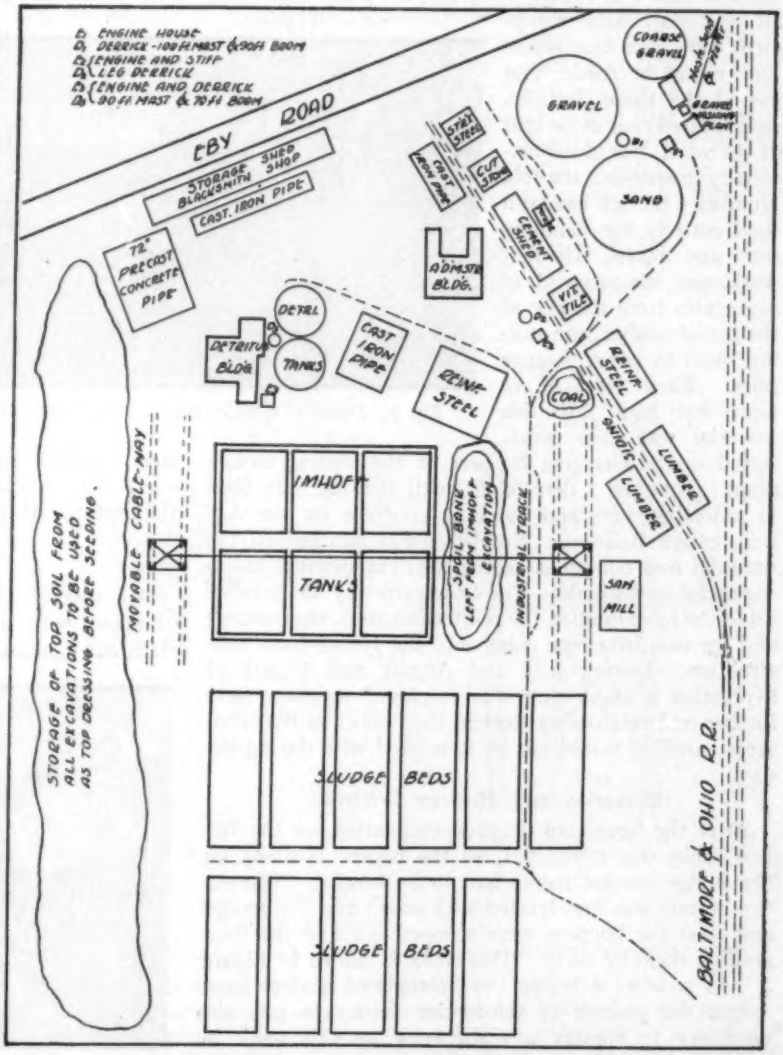


Fig. 1. Layout of Dayton Sewage Treatment Plant and Equipment and Storage Sheds

Fig. 2. Grading for Hopper Bottoms With Teams and Slip Scoops

general preparations were going on for expediting the whole job. The central mixing plant and cement shed were built, industrial tracks were laid, the derricks were set up and every plan was made to move rapidly when the time came. The general layout for handling the work is shown in Figure 1. This yard plan shows that all materials and equipment were kept near where they would be used. The use of the three derricks, each located near some unit of the work, has aided materially in speeding the job. Number 1 derrick has been used entirely for handling sand and gravel. Its first work was the removal of aggregates from the pile at the gravel washer, and storing them in larger storage piles. These were 50 or more feet high. All this material was then transferred to the charging hoppers of the central mixing plant. Number 2 derrick, a small stiff-leg, was used in unloading cars and handling concrete for the Adminstration Building. Number 3 has handled all the material and equipment going into the detritus building and detritus tanks. The 4-ton cableway has handled all of the form lumber, the reinforcing steel, the concrete and the cast iron pipe going into the Imhoff tank construction. During July and August and a part of September a night crew was employed to place form lumber and reinforcing steel in the "hole" so that concrete handling would not be interfered with during the day.

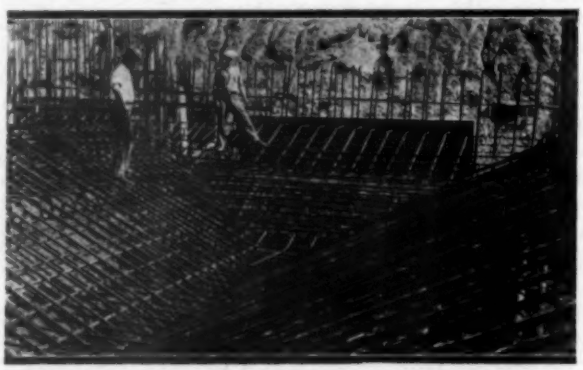


Fig. 3. Detail of Reinforcing Steel in Hopper Bottoms

Building the Hopper Bottoms

After the Sauerman dragline excavation for the Imhoff tanks was completed, all the hopper bottoms for the sludge compartments had to be formed. The entire bottom was first leveled with teams and slip scoops and then the hoppers were scooped out and the final grading done by hand. This work is shown in Figure 2. As soon as a hopper was completed a steel gang began the placing of reinforcing bars. It was also necessary to employ a night crew on this work in order to keep ahead of the concrete gang. Figures 3 and 4 give a good idea of the quantity of steel in this part of the work. No night work, however, was necessary on reinforcing steel after the bottom slabs were poured.

The determining factor for speed then was "how fast could the carpenters build forms"? Since the form lumber for walls was re-used there were two factors which affected the progress of the carpenters. The wrecking of forms and the re-erection. The use of the Dayton Sure-Grip form tie and spreader, even on battered walls, speeded up both wrecking and erection. The wrecking was all done by one man and a helper. In erection, only enough nails had to be used to hold the boards in place, two or three to a board, and the use of wood form spreaders was cut to almost zero. This factor alone eliminated the expense of a man to fish out spreaders as the concrete was poured. In the erection of the forms for the gas and scum wells lumber and time were saved because the boards had to be squared on one end only.

Reinforcing Steel

The reinforcing bars and the industrial track were both furnished by the West Virginia Rail Co. The reinforcing steel was all checked by the engineers, bent and tagged so that each piece had a place as shown on the prints. In the cross walls, supporting the baffles, each one-half wall required 41 stirrups, each of a different length. These then were numbered 1 to 41 and were placed in that order. When the bottom slabs were completed approximately 525 tons of steel had been placed and there were 9 pieces of steel left over. The inspector on steel counted the exact number of bars in each and every part of the job. The total number of pieces in the bottom slab or embedded in it was 21,122.

Concreting

All concrete has been mixed in a 1-yard mixer equipped with a Blaw-Knox batcher and inundator. This has insured a concrete of uniform consistency and

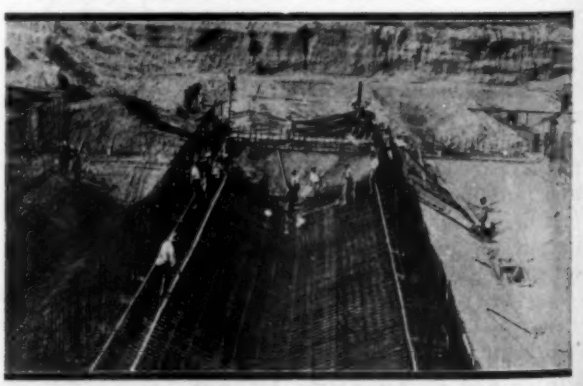


Fig. 4. General View of Hopper Bottoms, Showing Steel in Place Ready for Pouring Concrete

Fig. 5. Pouring Concrete for the Sludge Hoppers Without Forms

eliminated variations in water content, because of moisture variations in the fine aggregates. The quantity of mixing water has been varied between 5½ and 6¾ gallons per bag of cement, depending on where the concrete was placed. The use of Celite added to the general workability of the concrete and prevented segregation of grout and aggregate on the long hauls.

The greatest portion of the concrete, approximately 12,000 yards, went into the Imhoff tanks. The first of this was poured on July 5, and the last on November 13. During August 4,400 yards were placed. All concrete was hauled from the central mixing plant to the cable-way in 1-yard buckets and dumped for the most part directly into the forms.

Sludge Hopper Construction

The concrete for the slab forming the sludge hoppers was poured without forms. Figure 5. These slabs have a 2 to 1 slope and the concrete used had a 1-inch slump. The sloping baffle walls were formed and poured directly from the buckets. The top forms came to one foot of the peak of the baffle, leaving room for spading the concrete. When these forms were filled the boards were placed, completing the form and leaving a 3-inch space at the top through which the peak concrete was poured.

Baffle Wall Construction

Figure 6 shows in some detail the manner of forming and bracing these baffle walls. The large baffles were all formed and poured first. They became then a foundation upon which to build the forms for the small ones. These forms were all wrecked out from under the baffles in No. 1 and 2 tanks and re-used. This slowed up the progress and enough lumber was purchased to form the remainder. A total of 29 cars of new lumber, 655,464 feet B.M. has been used on the job. A total of 338 car loads of material has been unloaded on the plant siding. This includes material for the pumping station and the force main from the pumping station to the disposal plant.

Effluent Conduit

The effluent conduit, from the Imhoff to the river, was built of 48-inch precast concrete pipe, with vitrified liner plates cast in the pipe. This conduit passed under the Baltimore and Ohio Railroad track. An agreement was made with the railroad company by which they drove the piles and placed the supporting timbers which were furnished by the city. The contractor did the excavating and placed the pipe which was encased in reinforced concrete. At the river this conduit ended in a concrete encased cast iron multiple outlet ending in the middle of the Great Miami River.

The building of this outlet into the river required the construction of a cofferdam, and the placing of underdrains and pumping. The cofferdam was built of the material excavated from the stream bed with a dragline bucket on a steam excavator with a 75-foot boom. Three lines of 8-inch vitrified tile were laid parallel to the excavation, leading to a pump sump at the end and on the downstream side. A 10-inch electrically driven pump removed the water. The cast iron pipe was then placed on precast concrete blocks and encased in concrete. This work was done as a subcontract by the Charles F. Smith and Sons Co., of Dayton. They completed this work just in time to beat the first fall rise of the river. Their subcontract included also the conduit connecting the detritus and Imhoff tanks and all excavation for drain sewers and pipe lines.

Glass Covered Sludge Beds

The eleven glass covered sludge beds comprise the

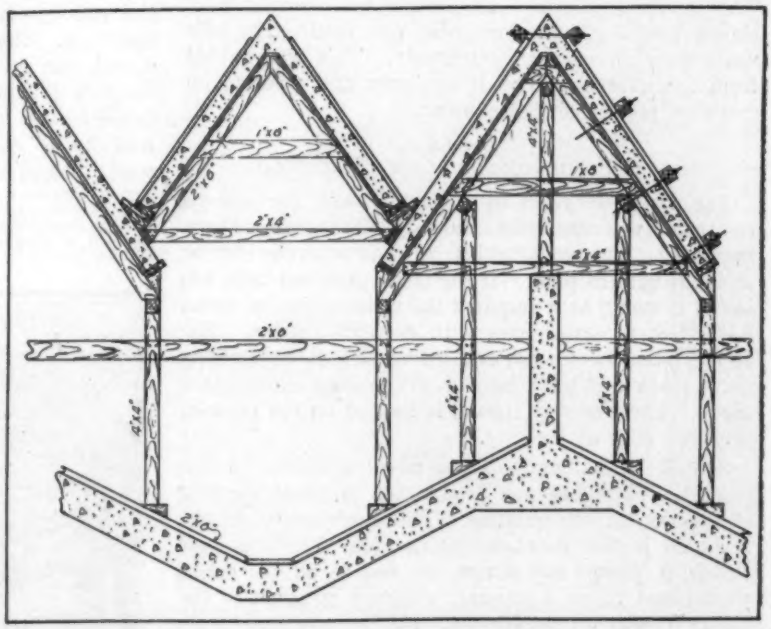


FIG. 6. FORMS FOR IMHOFF TANK BAFFLES

All top forms of the baffles were made in sections and held in place with pencil rods and button clamps. The shores shown in this figure were placed 3 feet apart the full length of the baffles. All 1 x 8 material shown was short lengths, and was placed approximately as shown in this illustration

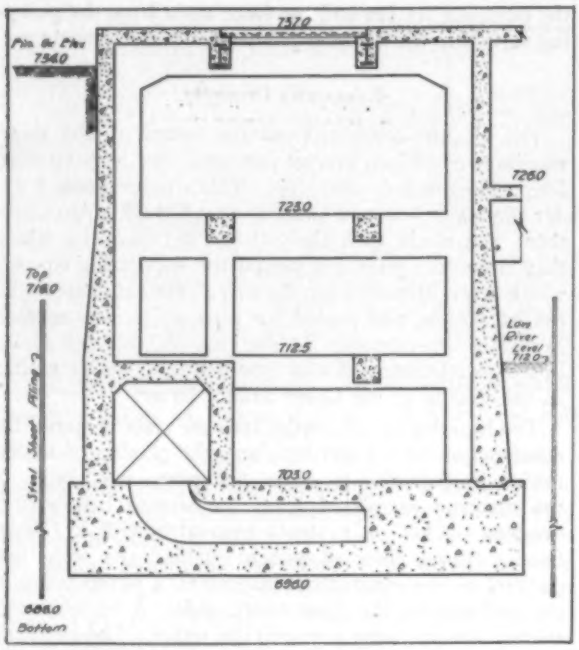


Fig. 7. Cross Section of the Pumping Station

largest installation that has been built to date. Each house is 60 x 162.5 feet with both top and side ventilators. There are four lines of underdrains running lengthwise of each house and also four lines of industrial track for the sludge removal. Nine of the houses are divided into two beds each while the other two are each divided into four beds. This arrangement permits of more flexibility of operation. The houses were furnished and erected by the Lord and Burnham Co. The erection, painting and glazing was completed in eleven weeks. Aluminum paint was used. The side walls were all reinforced concrete. This was hauled from the mixer in large dump boxes and wheeled on run-ways to the point of pouring.

SEWAGE PUMPING STATION AND FORCE MAIN

The river elevation at available sites for sewage treatment was such that pumping of the sewage was necessary. This could either be done near the city or at the treatment plant. If the latter plan had been followed it would have required the construction of about 8,000 feet of sewer lines with deep excavation. The former plan was chosen and a 54-inch precast concrete force main was built instead of the deep intercepting sewer. The pumping station is located on the river at the very edge of the city.

The E. H. Latham Co., was also low bidder on this project. Their bid was $160,510.75 to cover the cost of erection of the building. The electrical work was included in this contract but the four 300 h. p., one 150 h. p. pumps and motors as well as all the heavy piping was under a separate contract awarded to the Kelso-Wagner Co., of Dayton. Metcalf and Eddy were the engineers on this work also. Their estimate showed 7,260 yards of excavation, 2,700 yards of concrete requiring 160 tons of reinforcing steel. The structure is located within 100 feet of the river bank and as will be seen from Figure 7, the bottom of the concrete is 16 feet below low water elevation. Figure 7 also shows a typical cross-section through the building. The pumps sit on the floor elevation 703.0 and the motor on the floor at 737.0. The expectation was that the excavation would be quite difficult because of ground water so near the river. This, however, did not prove troublesome.

The excavation was done to elevation 716.0 by a gasoline shovel. The cofferdam of steel sheet piling was then driven around the entire building. As the excavation inside this piling proceeded with a clamshell bucket, operated from a derrick at the side of the excavation, the bracing was placed. This was designed very carefully, so as not to interfere with any of the concrete work. There were three sets of cross timbers, one just below elevation 716.0, one just below elevation 710.5 and the other just above elevation 703.0. Figure 8 shows the design of this bracing. All the reinforcing steel in the bottom slab was suspended from the lower timbers, which were removed as soon as the concrete was poured and the backfilling done between it and the piling. This left everything clear for the forming up to elevation 710.5. When this was poured and the backfilling done the second set of timbers was removed and everything was clear for forming up to the top timbers which were not removed until after the cross beams just below elevation 712.5 had been poured.

The sheeting was driven straight and proved to be almost water-tight. Some very slight traces of quick sand were encountered, but not enough to disturb the work. A system of underdrains was laid below elevation 696.0 leading to a sump at one corner of the building. A 10-inch motor-driven pump was installed but there was not enough water to keep it running more than one-half of the time, so a 6-inch pump was placed and run continuously. This kept the bottom in good condition. The bottom concrete was poured onto damp gravel, not into water. Outside of this cofferdam and concrete placing there were no peculiar construction problems on this part of the work. The work is now up to the ground elevation and the structural steel is being erected.

NOTE—The work has been done under the direct supervision of W. W. Morehouse, Director of the Dayton Department of Water. Roy Sands has been the General Superintendent for the E. H. Latham Co., and the writer, who will be superintendent of operation, has had immediate charge of all the construction.

Fig. 8. Bracing for Excavation for Pumping Station

A 5.22-Mile Grading Job in Rugged Country

By G. C. Brooking

Resident Engineer, Ohio Department of Highways, Bridgeport, Ohio

ON February 21, 1928, the Ohio State Highway Department awarded a contract to Williamson, Howard & Smith, contractors of Youngstown, Ohio, for the grading and drainage structures on 5.22 miles of S. H. (I.C.H.) No. 7, Ohio River Road in Belmont County, Ohio (Federal Aid Project No. 534-A). The approximate major quantities included in this contract are as follows:

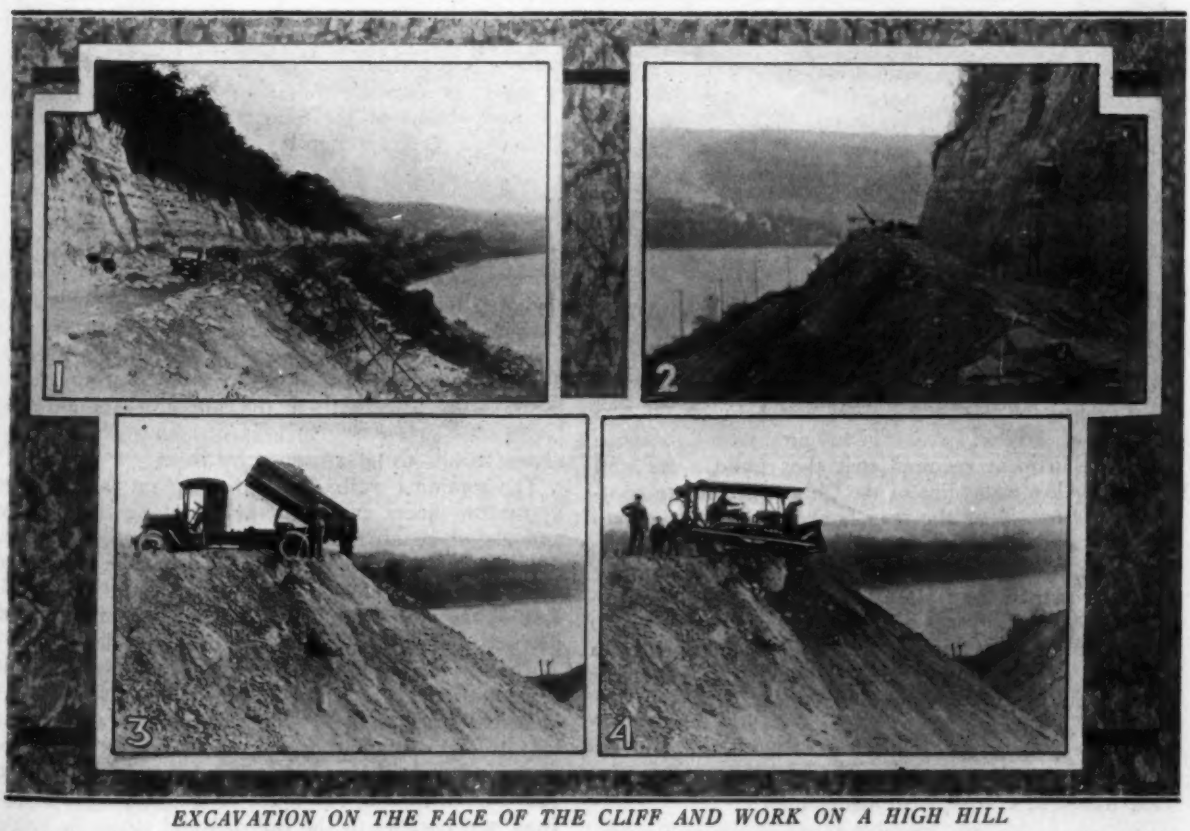
Roadway excavation	304,000 cu. yds.
Structure excavation and backfill	8,400 cu. yds.
1:5½ concrete in walls and culverts	3,300 cu. yds.
Reinforcing steel	367,000 pounds
Guard rail (wire cable and wooden rail)	14,600 lin. ft.
2-rail concrete fence on top walls	1,400 lin. ft.
12-inch corrugated pipe	1,600 lin. ft.
12-inch to 36-inch concrete pipe	1,600 lin. ft.

This project is situated along the Ohio River from Shadyside (Station 0), which is approximately eight miles below Wheeling, W. Va., to Dilles Bottom (Station 276). It is of considerable interest because the topography to be traversed is very rugged. It is also important since its completion and the completion of the adjoining project of five miles will open the Ohio River Road to through travel from the Pennsylvania state line on Lake Erie to the Indiana state line at Harrison, Ohio. An idea of the difficulties of the work can be gleaned from the photographs which show the close proximity of the water edge of the Ohio River, railroad location and precipitous hill.

Two Heavy Excavation Sections

The roadway cuts through two narrows, the first from Station 65 to Station 122 and the second from Station 165 to Station 195. The slope of the hillside is 1½ to 1. The excavation in the narrows averages 50 per cent rock.

The land adjacent to the roadway between the two narrows, or from Station 122 to Station 165, is on a



EXCAVATION ON THE FACE OF THE CLIFF AND WORK ON A HIGH HILL

1. A view looking toward Shadyside, showing the rough grading on the face of the cliff completed. 2. A view near the center of the project, showing the contrasting slopes above and below grade and a shovel working on an 8-foot cut. 3. A truck end-dumping at Station 128 for a high fill across a ravine. 4. A Caterpillar tractor with bulldozer building up the fill across a ravine

10 to 1 slope at right angles to the road. It is composed of a sandy clay soil. It is cut by eight narrow, very crooked and fairly deep ravines.

Ninety per cent of the total excavation is between Station 65 and Station 195 and at the rate of 120,000 cubic yards per mile of road. To make this excavation more difficult, this portion of the road parallels a single standard gage track of the Pennsylvania Railroad, a distance varying from 44 to 100 feet from the center line of the track to the center line of the roadway. The grade of the new highway is from 15 to 30 feet above the top of the rail of the railroad. It was at all times necessary to protect the railroad against dislodged material. Since there is at present no road along or between the narrows, it is necessary to travel 20 miles from one end of the project to the other and all equipment and materials from Station 65 to Station 195 was unloaded direct from the railroad cars to the job.

WASTE DUMPS

The roadway is 32 feet wide, except in the narrows where it is only 30 feet wide. The average haul on the

Location Sketch of Ohio River Road SH 7, Showing the Final Connecting Link, the Construction of Which is Described in the Accompanying Article

entire project is 3,300 feet and the maximum haul 5,600 feet. Since the land lying along and between the two narrows was too steep and the ravines too deep, and the War Department required that they build a sea wall along the low water line of the Ohio River before wasting any earth along the river bank, it was necessary to locate waste dumps on each end of the project.

There are two such waste dumps, one located on the left of the road from Station 53 to Station 56, containing 40,000 cubic yards with an average haul of 2,400 feet, and the other located on the left of the road from Station 200 to Station 210, containing 75,000 cubic yards with an average haul of 3,800 feet.

GRADING

The grading was started on April 2, 1928, the following mechanical equipment being used:

3 Lorain 75-h.p. 1¼-cubic yard gasoline shovels,
3 35-h.p. 110-cubic foot Chicago Pneumatic air compressors,
1 60-h.p. Caterpillar tractor with bulldozer,
2 30-h.p. Caterpillar tractors with bulldozers,
1 No. 12 Galion leaning wheel grader,
2 No. 10 Good Roads graders,
2 30-h.p. Hadfield-Penfield one-man graders.
5 iron mules (Fordson tractor type),
20 trucks (8 Whites, 5 Internationals, 5 Burghlan Specials and 2 Macks),
2 110-volt electric plants,
5 miles of three-way system wiring.
2 well-equipped machine shops.

From April 2 until September 26, 2 shovels, 2 bulldozer tractors, 2 graders, 8 trucks and 20 men worked 2 shifts of 9 hours each a day. From September 26 until November 1, 3 shovels, 3 bulldozer tractors, 8 trucks, 5 iron mules, 3 graders and 30 men per 9 hour shift were used. However, only 2 shovels were used at night. For night operation the contractor installed 5 miles of 3-way system electric light wiring with lights placed about 150 feet apart.

The equipment gave very good service. Repairs to a gasoline shovel were made now and then, but the delay caused by repairs was short. When the work commenced, the trucks used were not in good condition, causing a constant breakage of parts and greatly hindering the progress of excavation. Only 4 or 5 were kept running at any time. With the arrival of the dual-pneumatic-tired trucks, listed above, the time lost due to repairs was greatly reduced.

Delays due to excessive rainfall from April to August caused the contractor to lose 40 days. One shovel was damaged by a landslide, putting it out of commission for 10 days. Despite these handicaps, 60 per cent of the grading was completed by December 1, 1928.

BLASTING

The contractor found it possible to move the 50 per cent of rock excavation in the narrows without uniform blasting, but the excessive wear on shovels and trucks made it impracticable. Therefore, a system of blasting in layers or cuts of from 5 to 10 feet in depth was adopted. Some of the total cross-sectional cuts were more than 50 feet in depth.

STRUCTURES

The only structures of any importance except the retaining walls are one 16-foot concrete, flat-topper bridge and one 10-foot concrete arch 90 feet long. In the deep ravines between the narrows, reinforced box culverts were constructed ranging from 2 x 2 feet to 4 x 4 feet, each of which included highway-to-railroad-lateral drainage by use of 15-inch vitrified pipe leads topped with catch basins at the railroad ditchline. The boxes were necessarily of a special nature due to the excessive fills to be sustained by them.

The retaining walls designed to retain the roadway at narrow places and deep ravines along the narrows and elsewhere are of the "thin," or cantilever, type. Those placed parallel 16 to 20 feet from the center line of the highway were topped with a concrete guard rail. Two of the walls were constructed to prevent excessive property damage in the village of Shadyside.

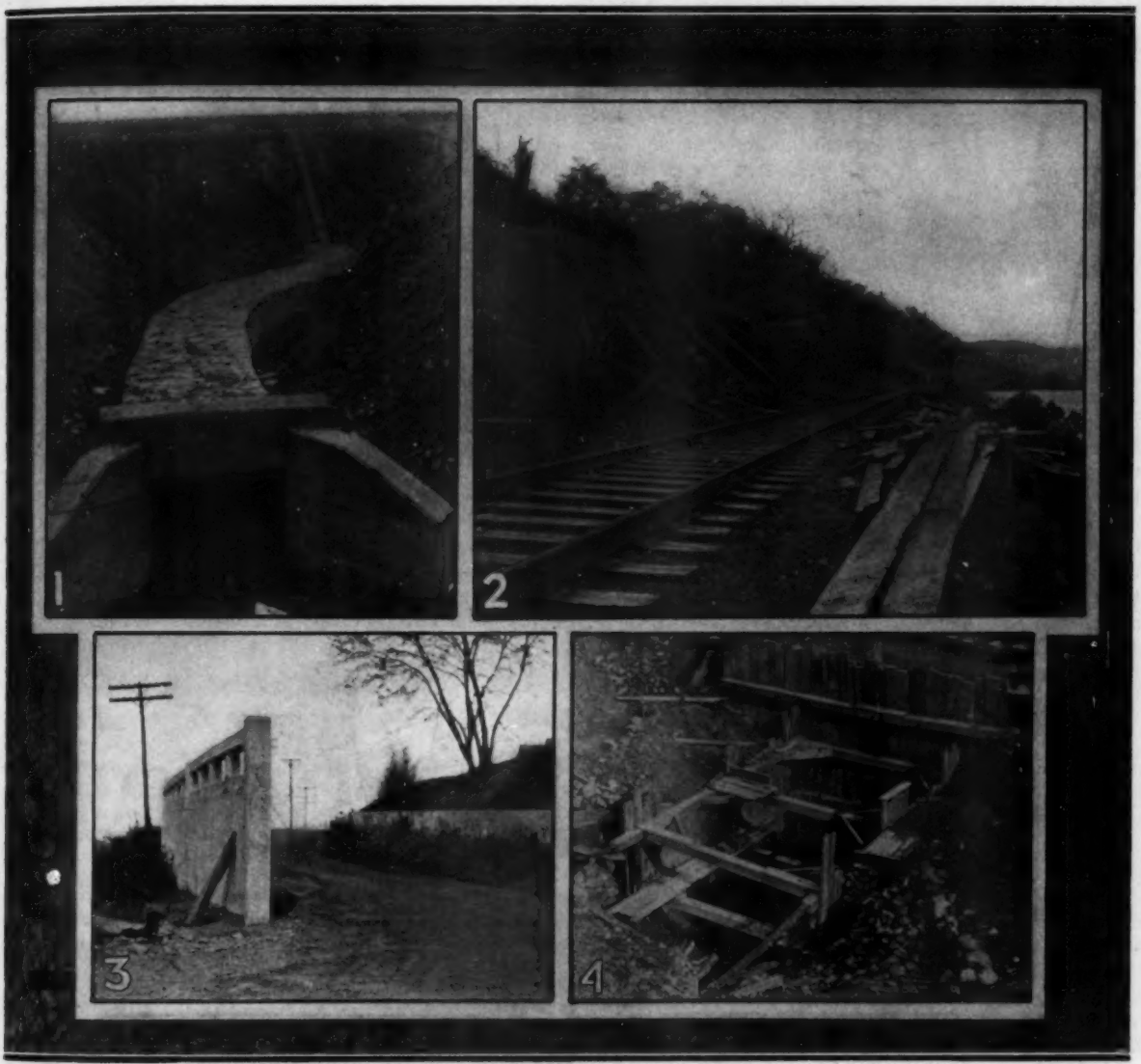
The two longest walls are located as follows: the first from Station 110 + 30 to Station 114 + 20. It varies in height from 12 to 22 feet. The face of this wall is only 16 feet distant from and parallel to the center line of the railroad; the second wall is located from Station 122 + 00 to Station 125 + 28. It is also 16 feet distant from and parallel to the railroad and varies in height from 12 to 42 feet.

From April 30, when the concrete work was started, until November 1, 2 crews averaging 20 men each were

employed. This work was partially sublet to 2 contractors who acted as foremen and each employed only one carpenter, the remaining men being unskilled laborers. The wall construction was slow and delayed the grading to some extent. The construction equipment used on this concrete culvert and retaining wall work was as follows:

3 1-sack Jaeger mixers,
1 2-sack Jaeger mixer,
1 Fordson tractor,
1 Concrete placing plant with 20-h.p. motor, steel track, cable, and 8-cubic foot car, wheelbarrows and small tools.

On the larger walls the placing plant proved indispensable due to its mobility, while on the smaller walls it was hardly worthwhile. Even with the above equipment and organization the concrete work progressed fairly well and the finished structures were good both for alignment and finish. Seventy-five per cent of the culverts and 20 per cent of the walls had been poured complete by December 1.



CONCRETE WORK ON THE SHADYSIDE-DILLES BOTTOM GRADING JOB

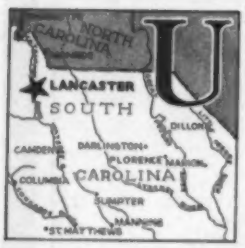
1. A typical box culvert, showing its construction to fit the railroad stone box culvert and a deep ravine. Note the 15-inch vitrified pipe lead for the railroad ditch drainage. 2. A wall near the center of the project, showing the concrete mixer and the inclined placing track. 3. A retaining wall built near Shadyside. 4. Excavation for a 42-foot high section of retaining wall and a culvert connection with the railroad culvert

PERSONNEL

For the Department of Highways, State of Ohio, Harry J. Kirk is Director, Robert S. Beighter is Chief Engineer, Ed. Stingel is Division Engineer, G. C. Brooking is Resident Engineer and Willard A. Riethmiller is Assistant Engineer and Inspector on the job. G. F. Howard is Superintendent for the upper narrows excavation from Station 50 to 100, Joseph Smith is Superintendent on the excavation between Stations 100 and 145, and Guy Smith is Superintendent for the excavation in the lower narrows between Stations 145 and 276. Concrete construction is superintended by B. C. Patterson and W. Yates, and Karl J. Smith was General Superintendent for Williamson, Howard and Smith, the contractors.

Construction Features of a Water Works Intake Cofferdam

By L. J. Jordan
Consulting Engineer, Charlotte, N. C.



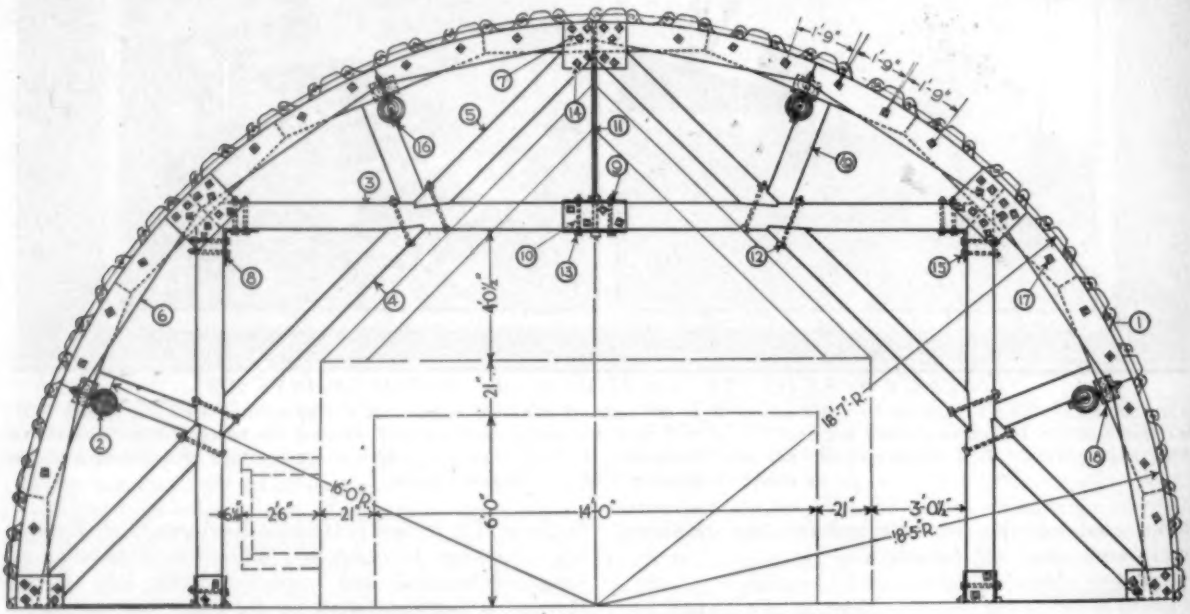
UNUSUAL water conditions were encountered during the construction of a raw water intake and pumping station on the Catawba River for the Lancaster Cotton Mills, Lancaster, S. C. The intake is located in the back water of the Fishing Creek pond of the Duke Power Co., and about twenty-five miles below another dam at Rock Hill owned by the same company. By the time the discharge from the flood gates of the Rock Hill dam has become dissipated the water begins to rise on the Fishing Creek pond. These conditions were expected in the case of floods in the river.

The site of the intake was near the Lancaster & Chester railway bridge across the Catawba River. It was learned that a wooden trestle had been burned there, a steel bridge had been washed off its foundations and subfloating material had formed a deposit there. During November, 1927, surveys were made to determine the nature of the underlying strata at the point selected for the intake. Borings on 5-foot squares with an earth augur showed rock at an elevation of 396 or about 16 feet below the surface of the banks. In about one-third of the holes, old logs, timbers and debris were encountered.

The depth from the surface to rock was insufficient for a suitable pile foundation, so a test pit was sunk to determine the quality and condition of the rock. This rock proved to be a soft granite formation and was considered to have sufficient bearing strength to support the structure to be erected upon it. This rock was excavated to a depth of 2 feet in order to form a recess in which to place the concrete structure. This was intended to aid in counteracting the force of the current down the river.

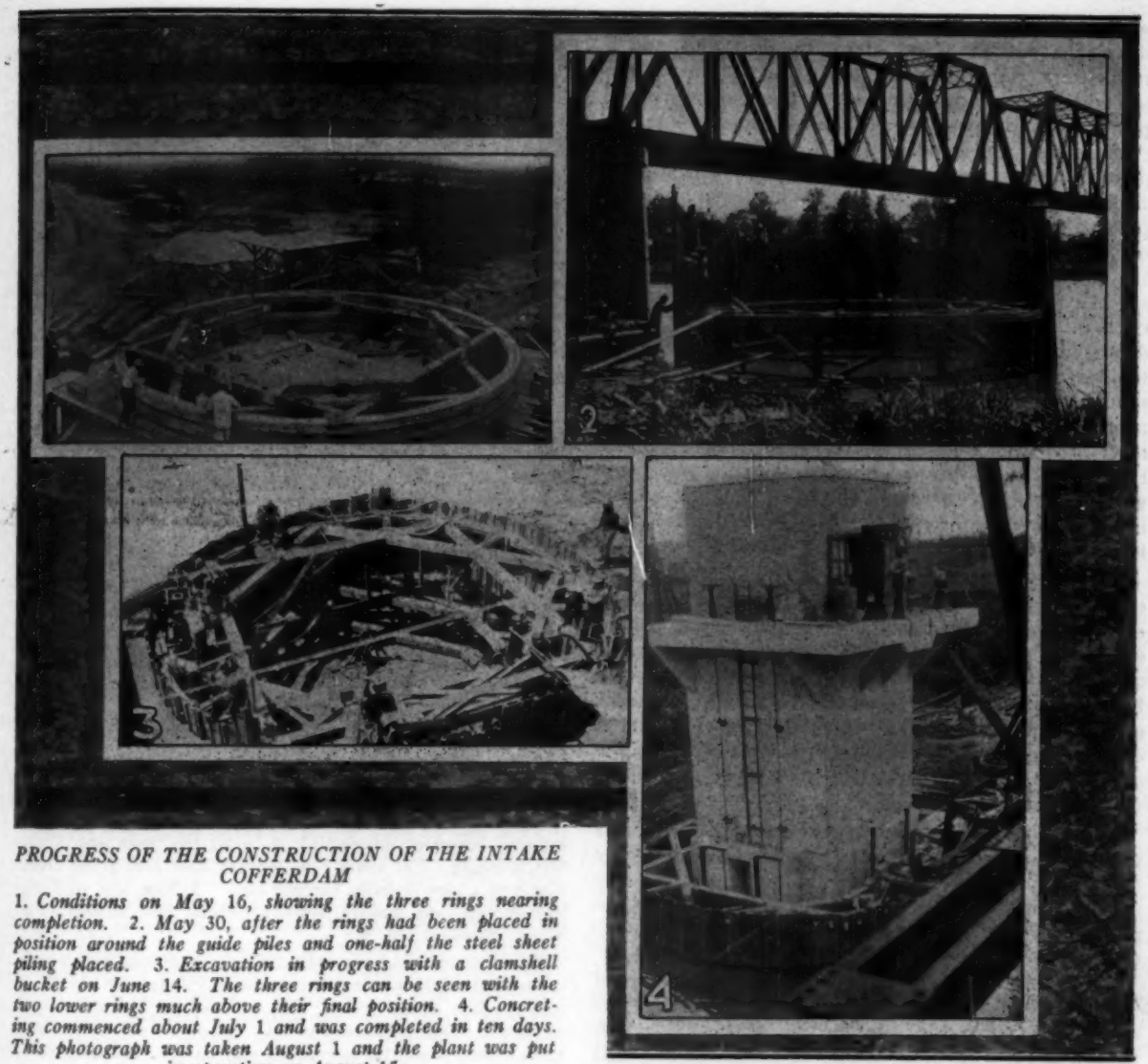
Preparations for Work During High Water

With a normal water level of 404.0 in November and a possible water level of 435.0 during high water, a type of construction had to be provided which would prove suitable for any condition at any time. Within a week after operations had been started the water rose to 417.6 and remained within 2 or 3 feet of elevation 412.0 for



HALF PLAN OF COFFERDAM FRAMING AND PILING

1. *One hundred and two steel sheet piles with* 14 *in. web and* 20 *ft. long.* 2. *Eight guide piles* 10 *ins. diameter and* 25 *ft. long.* 3. *Twenty-four* 10 *in. x* 10 *in. x* 14 *ft. braces.* 4. *Twelve* 10 *in. x* 10 *in. x* 10 *ft. braces.* 5. *Twenty-four* 10 *in. x* 10 *in. x* 8 *ft. braces.* 6. *Two hundred and forty* 2 *in. x* 12 *in. x* 7 *ft.* 3 *in. braces.* 7. *Twenty-four* ⅜ *in. x* 18 *in. x* 24 *in. plates.* 8. *Twelve* ⅜ *in. x* 10 *in. x* 24 *in. plates.* 9. *Twenty-four* ⅜ *in. x* 10 *in. x* 24 *in. plates.* 10. *Twenty-four* ⅜ *in. x* 10 *in. x* 24 *in. plates.* 11. *Twelve* 1¼ *in. diameter by* 7 *ft. bolts.* 12. *Forty-eight* ¾ *in. x* 18 *in. machine bolts.* 13. *Seventy-two* 1 *in. x* 12 *in. machine bolts.* 14. *Two hundred forty* 1 *in. x* 12 *in. machine bolts.* 15. *Forty-eight* 1 *in. x* 12 *in. machine bolts.* 16. *Forty-eight* ¾ *in. x* 18 *in. machine bolts.* 17. *One hundred and forty-four* ¾ *in. x* 12 *in. machine bolts.* 18. *Twenty-four* 6 *in. x* 10 *in. x* 2 *ft. blocks.* 19. *Twenty-four* 10 *in. x* 10 *in. x* 4 *ft. braces*



PROGRESS OF THE CONSTRUCTION OF THE INTAKE COFFERDAM

1. *Conditions on May* 16, *showing the three rings nearing completion.* 2. *May* 30, *after the rings had been placed in position around the guide piles and one-half the steel sheet piling placed.* 3. *Excavation in progress with a clamshell bucket on June* 14. *The three rings can be seen with the two lower rings much above their final position.* 4. *Concreting commenced about July* 1 *and was completed in ten days. This photograph was taken August* 1 *and the plant was put in operation on August* 15

several months. During the temporary lull in work due to high water, arrangements were made whereby the work could be carried on regardless of the river level.

As it seemed to be impractical to provide a cofferdam to take care of the highest water to be expected, a cofferdam was planned which would enable the work to proceed without difficulty even though the river should rise. The top of the flood gates at the Fishing Creek dam below the intake location was at elevation 416.5. Thus the impounded water could be at any elevation below this level, depending upon the will of the power company. But only in case of flood conditions was it likely to rise higher than this elevation. With the difference in elevation between the rock and the top of the flood gates, a cofferdam height of 20 feet seemed to be sufficient to overcome average difficulties.

STEEL SHEET PILE COFFERDAM

Fourteen-inch Lackawanna arch web steel pile 40.8-pound section, 20 feet long was driven in a circle of 37 feet 2 inches in diameter by a No. 7 McKiernan-Terry steam hammer and supported by three rings of 10-inch timbers carefully cut to fit the circle. Computations showed a requirement of 100 piles to complete the circle, but in actual construction 102 piles were required to fit this circle. The design of the bracing for the cofferdam was arranged to provide a clear working space of about 6 inches between the structure and the bracing. As a water-tight structure was of paramount importance, no chances were taken by permitting the braces to extend through the concrete. This necessitated a sort of semi-truss arrangement of the braces in order to carry the outside pressure. Each timber was carefully cut to fit and the whole ring structure made as one complete unit.

Three of these rings were made and placed at the proper elevation as the work progressed. The rings were made in quarter sections on a sort of platform and then carried to the intake location. The first ring was assembled on a temporary false work just above water level and placed true to line, or rather with its center true to a point. Then eight guide piles 25 feet long were driven inside this ring against the timber circles. The guide piles were placed with the derrick and driven

with the hammer swinging from the boom. They were then cut off 8 feet above the first ring and a frame-work constructed on top of these piles. The second ring was then assembled on this framework and placed in its true position over the first ring. These two rings formed the guide by which the steel piling was placed. Photograph 2 shows the method of placing the steel piling. After a number of piles had been placed in position wires were attached to the piles and anchored to the truss members to hold the piling in place until the circle was complete. The piling was then driven successively a few feet at a time by going around the circle a few times until it had been driven to the proper depth. This method of driving prevented the bottom of the piles from leaving the true circle in case obstructions should tend to swerve them. The removal of the piling upon completion of the work was accomplished by reversing the hammer and pulling with the derrick. In this manner the piling was removed with the same ease with which it was driven. The third ring was placed inside the steel piling ring in a similar manner and held in place 4 feet from the top of the piling.

The ring of steel piling was placed in the complete circle before any of it was driven. When it had been driven to rock the cofferdam was unwatered as the excavation progressed. As the excavated material was removed two of the rings were placed lower and lower by stages until in final position. The steel piling successfully cut through all the logs and debris encountered except a single piece of old steel which caused a couple of blow-outs before excavation had reached a depth at which it could be removed.

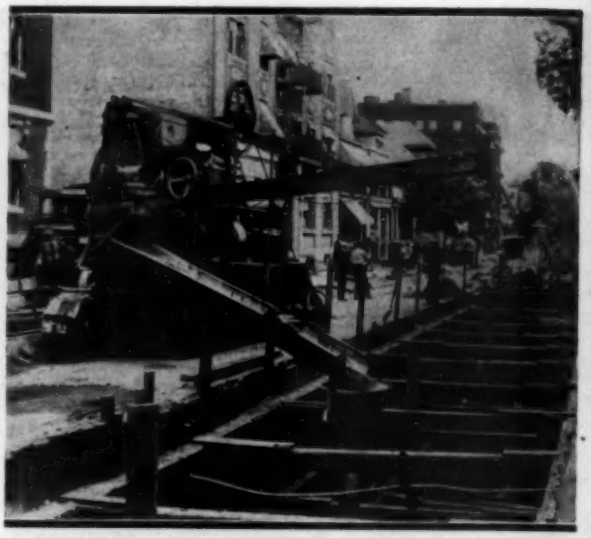
As the steel piling was placed in position Noah's pitch was applied to the tongue of each piece. As only the steel piling existed between the water pressure outside and the open space inside the cofferdam, the application of pitch served to make an exceptionally watertight cofferdam.

Water reached within a few inches of the top of this cofferdam, but never overflowed it. Provision was made in the methods of construction to permit the cofferdam to fill with water when the water reached that height. After the completion of the structure and before the equipment could be removed from the site a flood condition was reached.

The equipment used on this work consisted of a 10-ton derrick, 3-drum hoisting engine and swinging gear, 30-h.p. steam boiler for hoist, pump and hammer, 5-inch steam driven centrifugal pump, 3-inch pulsometer, two 4-inch gas engine driven diaphragm pumps, No. 7 McKiernan-Terry 5,000-pound steam hammer, ¼-cubic yard clamshall bucket and 2-bag No. 14-S Smith mixer with 4-cylinder LeRoi engine.

The accompanying pictures show the the different stages of construction. Although this plant is only a small structure it bears the unique distinction of being one of the few raw water intakes in this territory which was not flooded out of commission during the recent flood conditions. This condition is probably due to the excellent construction made possible by the use of this particular method of construction.

Tucker & Laxton, Inc., Contracting Engineers, Charlotte, N. C., were both engineers and contractors on this work. The writer made the design for the cofferdam and E. L. Scruggs was superintendent.



Smith 27-E Paving Mixer Pouring Concrete Through Chute and Tremie

A Difficult Sewer Job Finished Three Months Ahead of Schedule

WITH only 340 working days to complete a difficult sewer contract in Brooklyn, the Picvac Construction Co., Inc., devised a plan to beat the time limit. The job in question as described by A. R. D'Aleo, Secretary, Picvac Construction Co., in *Job Jottings*, was a sewer of reinforced concrete construction, 9 to 10 feet wide and 6,000 feet in length. The sewer runs through East 21st Street from Foster to Caton Avenues through Caton Avenue east to Flatbush Avenue, and through Newkirk Avenue, west to East 17th Street, Brooklyn, N. Y.

The contractor had unusually difficult conditions with which to contend, as there was heavy traffic to maintain on the cross streets. The trench was 12 feet wide by 30 feet deep in a sandy soil which required sheeting. All of the old sewers had to be bypassed and the streets are very narrow, averaging only 24 to 30 feet in width. These streets are asphalt surfaced and also are lined with large trees which had to be protected

Plymouth Locomotive and Train of Dump Cars Handling Backfill

against damage.

The work was opened at two points and progressed rapidly. Only 150 feet of trench was left open at each section of work. Several gasoline-operated Northwest crawler cranes were used on the excavating, shoring and placing of materials. Narrow gage steel side-dump cars drawn in 6-car trains by a Plymouth gasoline locomotive, carried the material from excavation to backfill. Ingersoll-Rand compressors and pavement breakers were used to open the street and I-R sheeting hammers were used to drive the wood sheeting. The cranes were used to pull out the sheeting when the sewer was finished. The bottom tier of sheeting, however, was left in place to avoid damaging the concrete. A 27-E Smith paving mixer was used to place the concrete.

In addition to the difficulties mentioned above, an unusually rainy summer further handicapped the work, but, in spite of this, fast progress was made. The work started in May and was practically completed in December, three months ahead of the engineer's schedule. This speed was made possible to a great extent by the organization and by the careful choice of plant equipment.

The Hubbard-Floyd Co., Inc., New York, furnished the Northwest crawler crane, the Smith paver, cars and Plymouth locomotive and the pumping equipment. The work was directly under the supervision of the officers of the company, Charles F. Vachris and Vito Picone, with offices at 4702 Glenwood Road, Brooklyn.

Treasury Department May Reject Bids of Irresponsible Contractors

THE Department of the Treasury in its administration of the Public Building program may accept the lowest responsible bid, rejecting bids from contractors failing to qualify as responsible according to a ruling of Comptroller General J. R. McCarl made November 17, 1928.

In line with similar decisions handed down by Mr. McCarl, the Secretary of the Treasury was advised that the financial standing of a prospective contractor with the United States should be such as to enable him to finance the difference between the cost of the work and the payments made by the Government of 90 per cent of the contract price of the work from month to month as the work progresses. In his conclusions, Mr. McCarl states further, "* * * * your Department will appear justified in rejecting the bid of any bidders not showing such a business and technical organization or nucleus thereof available for the contract work or such financial ability to finance so much of the work as the contractor would be required to finance or such building experience as reasonably to justify the conclusion that the requirements of the Government in this instance could not safely be intrusted to such a bidder.

"Having stated in the advertisement for proposals the requirements for a showing of the qualifications of the bidders, your conclusion as to the lack of qualifications on the part of any low bidder when reasonably supported by facts showing lack of a business or technical organization or nucleus thereof available for the work, lack of financial ability or integrity and lack of necessary experience, will not ordinarily be questioned by this office."

Training Welders for Diversified Work Necessary for Successful Operations

ONE of the most significant developments in the last year or two in the welding field is the attention that is being given in this country to procedure specifications in important welding operations. One of the prime requisites of proper procedure specifications is having qualified operators for the work to which they are assigned.

It is not sufficient to take welders who have had five years' or more experience and conclude that they are expert for the work in hand, according to the report of the Oxy-Acetylene Committee, International Acetylene Association. It is now recognized that a welder who may do excellent work on thin material will not necessarily be able without additional training to make good welds on thicker materials. For example, a man may do 100 per cent work on plate welding in a "flat position" but will make poor welds on pipe line work where some overhead welding may be required.

There is a tendency to classify welders and give them work for which they are particularly fitted. For example, in pipe line welding a welder may be able to do 100 per cent work in making joints with the pipe turned around to provide an easy position for welding, but he may utterly fail to make a good "bell hole" weld. It is, therefore, essential that a welder be tested for the work which he is to do. These specimens should be made up of material of the same thickness and with the same preparation which the welder will encounter in service. If vertical welding be required of him, some specimens should also be made in this position. The importance and necessity of qualifying welders by suitable check tests cannot be over emphasized. It has often been said that a chain is no stronger than its weakest link. A well set-up organization will see to it that proper materials and apparatus will be supplied. It can also be reasonably expected that the designing branch will work out designs particularly adapted to welding both from the standpoint of economy and dependability of the welds if properly made. It is, therefore, only reasonable to expect that the same care will be taken to qualify the welders for the work which they are expected to do. The designing department will then have accurate knowledge of what may be expected from a particular joint in service because they will know that the welders employed are capable of repeatedly reproducing a product of uniform known strength. It then remains for the regulatory or supervising force to see to it that such welds are produced.

Complete Oil Mix Plant Used on New Mexico Highway Construction

THE tendency toward greater elimination of hand labor in highway building is again demonstrated in the oil mix plant of the New Mexico Construction Co., which has the contract for the Roswell-Dexter job in New Mexico. The plant is run by electricity with gas and steam for subsidiary units. The clamshell bucket used for dredging the gravel from the pit before treatment is operated by gasoline and is movable, being mounted on a giant truck. The rock crusher and drying unit is powered by electricity. The screen for separating coarse and fine gravel is electrically operated.

From the screen the material drops into two separate piles which are directly over chutes leading into an underground compartment. Here one man by the manipulation of two levers proportions the materials by an automatic weighing bin which dumps the correctly combined rock and sand into an electrically operated conveyor which carries them to the mixer.

The mixer, a pug mill machine, mixes the two parts of aggregate with hot oil which is pumped in by a motor pump and weighed by an automatic weighing machine. The mixer then dumps its load into the waiting truck which carries it to the road where it is dumped again by power and later spread by power maintainers. From first to last no hand labor is put on the material.

A feature new to road contracting is the effort to make working conditions comfortable to the men employed. In the underground compartment, an ingenious machine has been rigged up which gives a constant circulation of fresh, cool air for the men employed at the weighing bins. Electric exhaust fans draw the air into one compartment and then expel it.

Wire Rope and Safety

By D. F. McMURCHY

Structural Engineer, Industrial Commission of Ohio, Columbus, O.

CONSTRUCTION of our larger structures has been aided more by wire rope than any other item of equipment in that it made possible the power equipment used in excavation erection and transmission without which our construction operations would be seriously hampered. Its ability to withstand abuse, combined with its great strength and flexibility, recommend wire rope for the severe service required of such equipment on construction work, and it has been our experience that the majority of wire rope failures are not the fault of the rope but are due to improper care, use and connections.

If we consider for a moment the construction of wire rope we immediately sense its limitations. As the name implies it is rope made of wire. The construction most familiar on building operations being 6 x 19, that is, 6 strands of 19 wires each twisted around a hemp center to form a rope. Three grades of wire are most commonly used in its manufacture—iron, crucible steel and plow steel. The latter two, because of their combined strength and flexibility, are generally used on construction operations as rigging for hoisting, transmission and excavating equipment. Frequently cables that have been removed from this equipment are again placed in service as guys on towers and derricks and as lashing, slings, etc. Other constructions are manufactured to serve various purposes requiring greater strength or flexibility but the 6 x 19 construction more nearly satisfies the contractors' requirements. Being made of wire it is not as flexible as hemp rope and cannot be bent sharply without seriously affecting its strength.

The contractor in ordering rope has to rely almost entirely upon the integrity of the supply dealer in the matter of getting the rope specified. Few workmen can tell by the appearance or feel of a rope whether it is iron, crucible or plow steel. Like Chinamen, they all look alike but their strengths vary considerably, iron rope having about 40 per cent and crucible cast steel about 85 per cent of the strength of a plow steel rope of the same diameter. Iron rope when bent with the hands does not have the tendency to spring back that crucible or plow steel rope have and may be detected in this manner, but the difference in spring between the crucible and plow is hardly perceptible and the test is not sufficiently reliable to determine the quality of the rope.

To overcome the uncertainty of using a rope of less strength than is required, the proposition of weaving into the hemp core a narrow tape containing information as to the material, strength and manufacturer has been advocated by several speakers and writers on the subject, and we have been informed that one manufacturer is labeling his rope in this manner. For the benefit of the manufacturer, dealer, consumer, and public such procedure should be followed by all wire rope manufacturers, thus removing this uncertainty of using a rope of less than is required.

Life and Strength of Wire Rope

Three major factors govern the life and strength of wire rope, external wear, internal wear and kinking. A new rope being circular in section, presents only the surface of one or two wires of each strand at any section to external wear against the sheaves and other objects with which it comes in contact. Abrasion against the sheaves augmented by gritty substances contained in the dust and mud ever present around construction operations tends to wear these outside wires very quickly, reducing their sectional area. As the process continues the next adjacent wires begin to wear but rarely more than three wires of any strand present a wearing surface to the sheave before one wire breaks. This failure increases the load on the other wires and with their decreased sectional area they fall rapidly.

External Wear

As a means of reducing external wear on rope it is essential that the sheaves be properly aligned and that the grooves of the sheaves are kept in good condition. Sheaves with broken flanges or that have oversize bores, not only increase the wear on the cable but also the hazard of the line jumping the sheave which often produces disastrous results. Running lines should be clear and well lubricated and should not be allowed to wear against any material which will tend to abrade them. The question of the use of hard or soft sheaves depends upon existing conditions. In some instances, it is found to be more economical to replace the sheave than the line; in others the opposite is true. A rope should be replaced, according to the Bureau of Mines, when the diameter of the outside wires has been worn to 65 per cent of their original diameter or if six broken wires appear in one twist or lay of 6 x 19 rope. It is recommended that rope be discarded if five wires are broken with 10 per cent wear on outside wires; four wires are broken with 20 per cent wear on outside wires and three wires are broken with 30 per cent wear on outside wires.

Internal Wear

Another factor affecting the life of wire rope in service is internal wear. Being flexible there is considerable internal motion in the rope as it changes direction under load as when passing over sheaves. The outside wires of the rope passing over a sheave are stretched more than the ones adjacent to the sheave. This unequal stretching produces internal motion within the rope which, unless it is thoroughly lubricated, tends to wear the rope from within. Where the rope is subjected to reverse bends as in the care of the load line on a derrick passing from the hoist engine under a sheave at the bottom of the mast and over a sheave a short distance up the mast, this stretching shifts from one side

of the rope to the other, increasing the internal motion and consequently the internal wear. It follows that the smaller the sheave, the greater the stretch in the outside wires. Wire rope manufacturers recommend sheaves of a diameter in feet equal to 4 times the rope diameter in inches for crucible steel or plow steel rope.

Internal wear can be materially reduced by proper lubrication and the use of larger sheaves. The latter is not always possible, being limited by the design of the equipment, but larger sheaves will pay their added cost in increased rope life where conditions permit their use. The value of lubrication cannot be stressed too strongly and the additional cost of lubricating them is negligible when compared with the increased life resulting. Proper lubrication will minimize the breaking of interior wires which weaken the rope and which cannot be detected by casual inspection.

KINKING

A third major factor is kinking. To sever a wire without the services of wire cutters we kink it and it breaks easily. Kinking has the same effect upon wire rope, it being nothing more than a twisted bundle of wires. We know also by experience that the harder the steel the more brittle it becomes, having broken soft iron or copper wire in one instance and steel piano wire in the other, the latter breaking with much less kinking than the former.

Kinking is probably the most destructive of the three major causes of wire rope failure as little warning is given of the weakened condition. Great care should be exercised in taking wire rope from the reel to avoid kinks. It is a good plan either to roll the reel along the ground or floor or to mount the reel on a bar and run the rope off as needed. When wire rope is taken from a coil, roll the coil along the ground rather than pull it from the coil laying flat. Wire lines are frequently snarled when a clamshell turns over or a load slips. Such occurrences very often produce kinks and sometimes snags. Snarled lines should be straightened very carefully and inspected for snags or kinks before subjecting them to loads.

There are other factors affecting the strength of wire rope such as unlaying of strands due to lack of seizing or serving, corrosion from various causes, fatigue and others, but the majority of failures in wire rope are traceable to the three major causes given above, providing, of course, that the proper kind and construction of rope was selected for the work in hand.

CONNECTIONS

Of the various connections manufactured the clip is used more frequently than any other type on construction work. Its cost, ease of application, efficiency and adaptability are responsible for its extensive use in preference to other types with greater efficiency such as leaded sockets or wedge socket connections. Clip connections can develop efficiencies of better than 80 per cent when properly applied but connections of this strength are rarely found. Many riggers prefer to stagger clips on clip and thimble connections for no other reason than that they have always made such connections in this manner. The "U" bolts when drawn too tight, as they frequently are, crush the wire line at the point of application, kinking the strands at that point. If the "U" bolts are placed on the free end of the line, the friction around the thimble reduces the load on the line at the clip, thus offsetting in a measure the decreased strength due to the crushing effect of the bolt. When applied in the opposite manner, the weakened section directly under the bolt is subjected to the full load. Better connections are made by using more clips rather than applying a few in such a manner that the rope is crushed. Clip connections on new lines should be watched very carefully until the line takes its stretch. As the strands adjust themselves under load and compress the hemp center, the rope decreases in diameter, thus loosening the clips. The "contractor's standby," much maligned by safety men as being dangerous, is far more efficient and dependable than some clip connections commonly found on construction work. While the half hitch kinks the line and reduces its strength probably 50 per cent the connection is dependable up to this limit even when applied in a relatively careless manner and the load on the line rarely reaches 50 per cent of its ultimate strength. The wedge socket has some advantages over other connections in efficiency and ease of application but is more expensive and does not have the adaptability of the clip.

ACCIDENTS

Accidents in which wire rope is a factor are not limited to those caused by the failure of the line itself. The records of the Industrial Commission of Ohio show that accidents due to wire rope failures are quite infrequent, there being only one in the construction industry this year. In this case a boom line on a derrick parted and two men were struck by the falling boom. There are others, however, in which wire rope is a factor but not the cause of the accident. Just recently a laborer on an operation in Cincinnati was killed when a splice in a hoist line made with one clip failed, allowing the platform of the inclined hoist to run to the bottom of the incline, crushing the workman against a pile of lumber. Two workmen were electrocuted in Akron when the lines of an excavating machine came in contact with a high tension wire. A workman received a fractured skull when a hook pulled off of a lug on a section of steel stack which was being moved along the floor by means of a winch. He was standing about 20 feet from the stack and about 3 feet from the line when the hook snapped back and struck him in the head. We receive numerous reports of lacerations and falls caused by men running into moving lines placed near the floor and not infrequently reports of mangled hands and arms which have been drawn into snatch blocks and sheaves located within reach of workmen.

Accidents of this kind are of sufficient frequency and severity to warrant the constant attention of the safety engineer on construction operations. Some of our contractors put their sheaves up out of reach and provide barriers for all running lines near the floor or ground as a means of preventing accidents from this source. In my opinion, rules of standard practice governing the use and care of wire rope and the various types of connections should be made available to every user of wire rope as a means of increasing the life and safety of wire rope and of reducing the number of accidents.

ACKNOWLEDGMENT.—From a paper read at the National Safety Congress, New York City.

Subdrainage Stabilizes Fill and Subgrade on Illinois Relocation

Seepage from Bluffs Above and River Marsh Below Imposed Serious Limitations on Location of Road

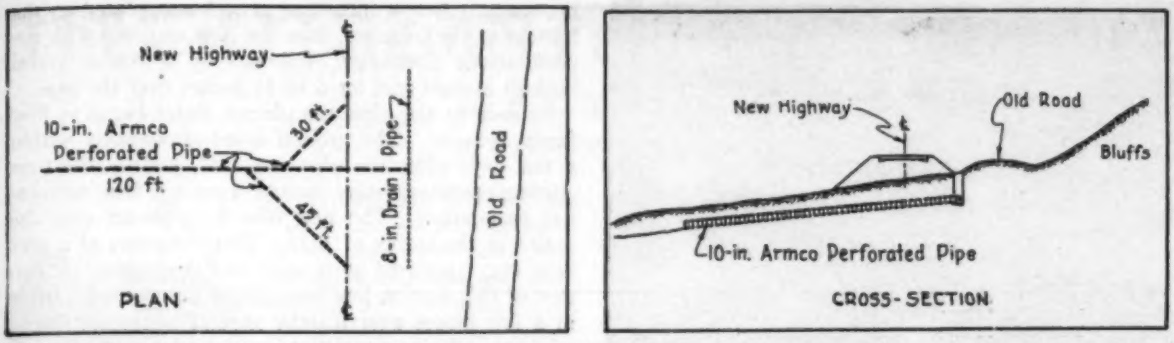
DRAINAGE, as a means of overcoming one of the most serious obstacles in roadway location, is well illustrated in the construction of the new State Highway No. 116, between East Peoria and Spring Bay in Tazewell County, Illinois. The old road followed a winding course between the bluffs and the Illinois River. At normal stage the river was from 100 to 1,000 feet from the old roadway, which was above high water, except during extreme floods. The new highway was located along the route of the old one, here and there taking a more direct course through the toe of the bluff or across the flat along the river side of the old road.

In crossing the low ground towards the river, particularly difficult soil conditions were encountered. The bottom land is of a very unstable, marshy character, being composed of peat, decayed vegetation, and sandy loam. Being at the base of the bluffs, these areas are rendered perpetually spongy by seepage. The spongy condition was indicated by its quaking readily under the weight of a man, and by the fact that a 9-foot iron rod could be pushed down its full length with only a slight pressure of the hand. Ground water flowed under a head from pipes driven into the ground.

Low Ground at the Foot of the Bluffs was Saturated. Ground Water was Under Hydrostatic Head, as Proved by the Spouting from the Pipe, Shown Driven Into the Soil

Experience and judgment indicated that unless ade-

Illinois Highway No. 116 is Located Along a River Bluff. Several Filled Sections, One of Which is Shown in the Foreground, were Stabilized by Subdrainage



Plan and Cross-Section of a Typical Self-Drainage Construction, Showing the Location of Intercepting and Cross Drains

quate provisions were made to drain away the ground water, new embankments would be unstable and the supporting power of the pavement subgrade would be uncertain.

Intercepting Subdrains Installed

After studying all the evidence obtainable from the history of the road and reports from residents, which showed that the road had been filled in from time to time until it became compact enough to support traffic, it was decided that subdrainage was an absolute necessity if the contemplated relocation was to be used. An investigation showed that the old tile drain had ceased to function, consequently it was realized that a new subdrain must be installed which would function indefinitely without becoming seriously impaired. The problem resolved itself into first intercepting seepage before it could reach the road and then carrying the water under the road to a point safely beyond the fill.

To intercept the ground water in each instance a line of 8-inch drain pipe was placed in a trench along the uphill side of the new embankment. Carrying the water across the road was more of a problem. The cross drain was required to function both as a carrier and a collector of water from the surrounding fill. It also had to perform this double function in unstable ground which would undoubtedly be subjected to uneven settlement. Further, the weight of traffic, pavement and fill imposed the requirement of structural strength. The final requirement was that the drains be free from clogging, which applied to the parallel intercepting drain as well as to the cross drain, although the side drain would be acceptable for relaying while the drain under the pavement would have to be put down permanently.

Experience in stopping landslides showed that perforated iron pipe would meet the requirements and it had the additional advantage of easy and rapid installation.

Installation of Drainage

No particular difficulty was encountered in installing the drains, all of which were placed before the new fills were made. Trenches for the pipe varied from 1 to 8 feet in depth and it was necessary to sheet several of the trenches. Armco perforated iron pipe 10 inches in diameter was used, mostly in 20-foot lengths. These were quickly fastened together in the trench by means of corrugated connecting bands, making a single,

Above—Ditches Carried Water as Soon as Dug. Right—Laying Armco Perforated Corrugated Subdrain

Outlet End of a Subdrain After the Completion of the Fill

strongly connected line.

Water flowed freely in the trenches before the pipe was placed—which was further proof that drainage was necessary. A few inches of gravel was placed in the bottom of the trenches, then the pipe was laid with the perforations downward, followed by a coarse gravel backfill around and for 6 to 12 inches over the pipe.

As soon as the pipe was placed, water began to flow freely from it. The ground dried appreciably within a few days after the pipe was laid, and by the time grading operations were started it made a firm, substantial foundation. The new fills were placed over the drains in the spring of 1928. Three-quarters of a year later they appeared quite solid and unyielding. A portion of this section has been paved permanently, while in a few places over marshy ground where settlement might possibly occur following the winter, gravel was placed temporarily.

PERSONNEL

The installation was made under the direction of Theodore Plack, district engineer, Illinois Division of Highways, with E. J. Wendell as resident engineer. The work was done by S. J. Groves & Sons Co., grading contractors, with R. C. Flake as foreman.

Specifications and Construction Recommendations for Vitrified Brick Pavement

IN the report of the investigation of paving and general highway conditions by the Engineering Commission appointed by the National Paving Brick Manufacturers Association, only general fundamental recommendations are made relative to specification requirements for materials and construction methods. Several highway engineering agencies have this matter under consideration and new specifications are being prepared covering the points on which there has been some difference of opinion in the past. The following general recommendations have been made by the Commission:

VITRIFIED PAVING BRICK

Vitrified brick for use in pavements should be thoroughly annealed, tough, durable, non-absorptive, and uniformly burned and free from marked laminations. They should conform to the standard tests of the engineering societies and the sizes agreed upon by the Hoover simplification committee.

SUBGRADE

The stability of a pavement depends upon the foundation. The local soil conditions must be considered in providing adequate drainage of the subgrade. A stable subgrade must be maintained under all weather conditions to insure a durable pavement. If the soil conditions are not favorable to proper drainage, it will be necessary to provide material which will produce satisfactory drainage. The uniformity of a subgrade vitally affects the durability of a base course and for that reason great care must be taken to provide for continuous and uniform compactness throughout the length of the pavement.

ADEQUATE FOUNDATIONS

An adequate foundation for a brick pavement has been very forcibly stressed. This term is used because it implies that the foundation must be strong enough to support the pavement under the different climatic and subsoil conditions. Where the traffic is light in sections where there is no frost, a well-drained sand or gravel subsoil may serve as an adequate foundation. Old stone, slag and gravel roads are also adequate under certain traffic conditions. Bituminous concrete foundations are also used. Florida lime rock and chert foundations are used in some of the southern states. The generally accepted foundation where there is any appreciable amount of traffic is concrete and this will vary in thickness as well as in the mix used under the different traffic, climatic and subsoil conditions. There is no such thing as a standard adequate foundation. The facts in each instance should govern the determinations of the strength of the foundation, but nothing should be overlooked to insure its being adequate. The actual surface of the foundation should be smooth. Variations shown by a 10-foot straight edge should not exceed ¼-inch.

CURB

The type of curb must meet the requirements of each particular job. Concrete curb should not be less than 6 inches in width. Steel curbs may be employed and the brick surfacing placed at the edge of the concrete base.

BEDDING COURSE

A sand or granulated slag cushion not exceeding one inch and preferably ¾-inch in depth has proved to be the most desirable bedding course.

LAYING BRICK

It is essential that brick should be laid in a manner either by the use of a lug or otherwise which will definitely provide a sufficient space between the brick for the application of the filler. The filler should fill the space between the brick from the top to the bottom of the brick. The 10-foot straight edge should be in constant use to obtain smooth and uniform surface and the rolling should be continued until satisfactory results have been accomplished.

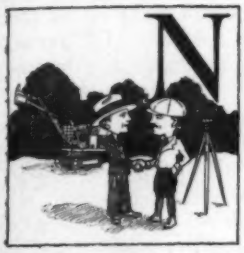
ASPHALT FILLER

An asphalt filler has proved to be the most satisfactory and is recommended for general use. Investigations should be made by the engineering societies to determine upon a standard specification for a filler best adapted to this service. It is essential that the temperature of the filler should be such that it will readily fill all of the space between the brick. The asphalt filler should not be applied when the bricks are damp or cold. Under such circumstances, provision must be made for heating and drying the pavement.

The City Engineer and the Contractor

By P. L. Brockway

City Engineer, Wichita, Kansas



NOT so long ago the old rule "Let the buyer beware" seemed to be the ruling motive in public contract work. At best the performance of the contract developed into a battle of wits between the engineer and the contractor with the contractor having the advantage because he had more representatives than the engineer. At its worst, many yellow scandal-mongering publications could supply the lurid details. All the equipment needed could be purchased for a very small amount. Just a few dozen picks and shovels, wheelbarrows, maybe some trench braces, a water barrel and a few buckets. The whole outfit could be abandoned without material loss at the end of the season. Moving from place to place was a simple matter.

Development of Machines

Then labor began to grow scarcer, wages tended upward, labor-saving machinery began to develop and a new era dawned. One does not have to be very old to remember the first loading skip on a concrete mixer. Concrete carts were next replaced with self-propelling mixers. To these have been added crawler treads with two speeds forward and reverse. Then came central mixing plants, eliminating waste of time and materials. Larger units were forced by the mass production required in highway construction. Excavating machinery replaced hand methods in all kinds of construction work. Even grading and tamping and floating concrete are done by machinery.

The net result is that almost any responsible municipal contractor has an investment of $50,000 to $100,000 in his equipment if he is to meet the competition of mechanical methods. This equipment creates a heavy overhead expense whether it is at work or not. Its operation requires a corps of skilled operators who must be paid whether they work or not or else they will be lost to other positions and it is expensive business to build up a new organization. Moving is expensive because of actual freight expense and because of costly loss of time.

Honesty the Best Policy

It, therefore, becomes the aim of the contractor to build up a local business, just as far as possible, and if he is good enough in his business ability to succeed at all, he is shrewd enough to know that in the long run honesty is the best policy. Entirely aside from the trend in human affairs whether for better or worse, the less successful contractors who are inclined to depend on "skinning" a job and hunting other fields, are being constantly eliminated by these conditions.

Contracting, municipal and in other fields, is, therefore, becoming big business, employing big business methods and operated by broad-gage, wide awake men. In fact, an ever-increasing number of contractors and their superintendents are recruited from the ranks of trained engineers. There are certain difficulties in construction work which appeal to capable men and the financial returns are better and tenure of office more certain on the construction side than on the designing and supervisory side of the work.

In dealing with a new contractor, it is, therefore, wise for the city engineer, to assume that he expects and intends to comply with the spirit of the specifications until it is discovered otherwise. The attitude toward a man that you expect him to be a thief and a rascal is the surest way that can be devised of developing him into one. Nothing is gained by perpetually nagging at a contracting organization about trivial, inconsequential details. His friendship is the best assurance the engineer can have that his work will be the best possible.

The attitude of the engineer concerning methods of construction should be, as far as possible, that it is strictly the contractors' own affair how the work is done so that the desired end is gained in a reasonable length of time. Modifications of plans must be critically examined, of course, before the engineer allows them, but any detail which can be altered to simplify and expedite the work should be allowed. The fair-minded contractor will in turn most readily alter other details which will improve the results.

Extras

There is also no advantage in being too reluctant to allow reasonable bills for extras, any more than in being too liberal. If extra bills are scaled down for no other reason than that they look too big the contractor's organization can easily pad them to allow for the reduction and it is sometimes exceedingly difficult to uncover the padding if it is skillfully done. It is far better to freely approve actual extra expense after full understanding as to what will be extra and it is imperative that approval be made at very frequent intervals. There probably never was a construction job of any size in which slight alterations did not present themselves to the attention of the supervising engineer during the progress of the work. In fact, all specifications recognize this fact by making open provision for them. No contractor will object, providing he is given sufficient advance notice to avoid interference with his construction program and provided he is reimbursed for his actual outlay in accordance with the terms of the contract.

Lucid Specifications

Specifications should always be written in the plainest, simplest language possible with short sentences and no possible chance for ambiguity in meaning. There is nothing gained in adding a lot of useless words. Some-

times the essence of the things desired is actually buried in a multitude of redundant paragraphs. Brevity and conciseness are general characteristics of the specifications of engineers who have grown old in the game.

FAIR PLAY

A reputation for fair play is worth more to the engineer in obtaining work done as he wants it and to his clients for getting the best possible contract price than the most binding and explicit set of specifications ever devised. The engineer would ordinarily be surprised if he knew how soon his reputation for fair play, for taking advantage of every possible technicality, for vindictiveness, for well-considered plans and interpretations, for supertechnical inspection, for lax inspection, for fits of bad temper or for other any outstanding characteristic is common knowledge among contractors who are possible bidders.

Contractors will always be present with reasonable bids where work is to be handled by an engineer well known for his ability and inclination for fair dealing with any contractor who is doing honest work with an efficient organization. Contractors generally dread to work under the responsible direction of an inexperienced engineer. The engineer with little or no experience at all is accustomed to accepting the printed page as the literal truth and is at a loss in deciding the numberless details which no specification can cover, to say nothing of adjusting manifest discrepancies.

This discussion so far has considered only those contractors who are responsible, who prefer to work under the assumption that they are expected to render intelligent and efficient service and that, having completed their obligations in this respect, their compensation is assured without any other factors entering into the situation than the usual possible delays incident to financing the work.

INEXPERIENCED AND UNPRINCIPLED CONTRACTORS

Unfortunately, a minority of contractors have the same human failings as the minority of folks in other occupations. "Quitting time and pay day" are the two desired aims of some laborers. The same thing on a larger scale is the principle aim of some contractors. Just as responsible contractors prefer to pass up work handled by inexperienced or over-exacting engineers, so do engineers prefer to eliminate the inexperienced or unprincipled contractor. This can be done in work handled for private corporations where bids are submitted by invitation, but in municipal work no one who can give bond can be barred from competition and it is a hardy engineer, indeed, who will recommend that the work be awarded to any except the lowest bidder. Should the contract not be awarded to him on the ground that he is incompetent or for other valid reason, he can always obtain a considerable following by persisting in bidding at lower and lower prices, at least among a certain class of people who are rather inclined to believe ill of all public officers. Such a contractor usually does not last very long if he does gain a few contracts, but there seems to be a perennial crop of irresponsibles to take his place. In handling work done by such a contractor, there is only one course for the engineer to take, redouble his vigilance, add extra competent inspectors and require the essential parts of the work to be as true to plans and specifications as is humanly possible.

The most permanently unsatisfactory contractor to deal with is the man who breaks into the game from the side lines just because it looks easy and because in his ignorance of costs, he over-estimates the profits. He has little equipment and no organization. No amount of advice or instruction or inspection can make up for the ignorance of a contractor or his foreman. Of course, the engineer retains the right to discharge any incompetent or insubordinate employee, but it is a right to be exercised only in the most extreme or exaggerated cases. If the contractor has a conscientious character he will in time realize his mistake and will listen to the hints and advice of a competent supervising engineer. He must, however, be allowed to work out his own blunders for a while in order to be in a receptive mood concerning the engineer's suggestions. It is indeed a delicate situation requiring all the tact and diplomacy that it is possible to muster. In the meantime the engineer is, of course, open to the criticism of an outraged public on account of poor progress with perhaps considerable inconvenience as a result.

ACKNOWLEDGMENT.—A portion of a chapter on The Municipal Engineer —from a forthcoming book on municipal engineering by Mr. Brockway.

Recovery on Special Assessment Certificate Denied on Uncompleted Paving Contract

The city of Quanah, Tex., contracted for the paving of nine blocks, but the contractor paved only six blocks. When suit was brought by the contractor against an owner of property at the end of the sixth block to recover on a special assessment certificate issued for the work, the property owner successfully defended on the ground that he did not receive the benefits contemplated when the assessment was levied. (Harwell vs. Jordan Construction Co., 4 S. W. 2d Series, 980, decided by the Texas Court of Civil Appeals, February 1, 1928.) As to the contractor's excuse for failing to pave the remaining three blocks, the court said:

"The fact that some of the property abutting on the three unpaved blocks constituted the homesteads of various parties, and that, as to some of them, the cost of the street paving could not be recovered, furnishes no defense. This should have been ascertained in advance of the signing of the contract. The contract should not have been entered into on the basis of paving of the nine blocks, but, as it was entered into, the defendant had the right to estimate his benefits from the whole contract, and not from a part performance thereof."

A Morris 4-Inch Contractors' Pump Direct Connected to a 15-horsepower Le Roi Engine

Who's Who in Construction

A Series of Reports from Active Contractors Published Monthly

BUS. VOL.—ANNUAL VOLUME OF CONTRACTS
A—Over $5,000,000
B—Between $1,000,000 and $5,000,000
C—Between $500,000 and $1,000,000
D—Between $250,00 and $500,000
E—Under $250,000

Photo by Blank & Stoller
Ernest L. Smith

Ernest L. Smith Construction Co., Inc., New York, 70 East 45th Street. Organized: July, 1920. This company is the successor to the George Sykes Co., which was organized in 1907. Officers: Ernest L. Smith, President and Treasurer; Walter M. Collins, Vice President and Secretary. Major contracts: 1925-6-7, substations for New York Edison Co.; 1926-7, passenger stations for Long Island R. R.; 1927, Parish House, Church of the Redeemer, Morristown, N. J.; 1928, Warner Library, Tarrytown, N. Y.; Bates Building, Church and Thomas Streets, New York. Member: New York Building Congress and Queensboro Chamber of Commerce.

Schweinsberg Construction Co., Bay City, Mich., 700 Adams Street. Organized: May, 1928. Bus. vol. E. This is an incorporated company engaged in road, pavement and general contracting. Officers: Carl Schweinsberg, President; E. J. Whyte, Secretary and Treasurer. Major contracts; 1928, 8¾ miles pavement, Bay County, Mich.

The William E. McHugh Co., Cleveland, Ohio, 3855 West 44th Street. Yards and Plants: Ridges Road, Wheeling and Lake Erie Railroad. Organized: 1920. Bus. vol. C. This company is an old organization of general contractors, completely equipped for all types of municipal, county and state paving jobs. Officers: William E. McHugh, President and Treasurer. Major contracts: various paving contracts, $1,500,000. Member: U. S. Chamber of Commerce.

Alfred Lewald, Inc., St. Louis, Mo., 6025 West Cabanne Place. Organized: 1926. Bus. vol. D. Prior to the date of incorporation in 1926, Mr. Lewald operated as an individual. Officers: Alfred Lewald, President and Treasurer; M. S. Eames, Vice-President; N. E. Lewald, Secretary. Major contracts: mainly paving contracts with the city of St. Louis and suburbs. Member: Municipal Contractors Association, St. Louis.

F. W. Schwiers, Jr., Co., New York, 90 West Street. Organized: 1910. Bus. vol. C. F. W. Schwiers & Co., was organized in 1901 and in 1903 became Dean, Schwiers & Sutton & Co. This name was changed in 1907 to Schwiers & Sutton Co., and in 1910 the present company was organized as F. W. Schwiers, Jr., Co. Officers: F. W. Schwiers, Jr., President and Treasurer; William Schwiers, Vice President; Marguerite Schwiers, Secretary. Major contracts: bridge, Pompton Lakes, Passaic County, N. J., $150,000; reinforced concrete boardwalk, Wildwood, N. J., first unit, $130,000, second unit, $200,000; bridge, Atlantic City, N. J., $200,000; toll bridge, Somers Point-Beasleys Point, N. J., over Great Egg Harbor Inlet, $600,000.

Photo by Blank & Stoller
F. W. Schwiers, Jr.

Member: Associate Member, American Society of Civil Engineers.

Booth & Flinn Co., Pittsburgh, Pa., 1942 Forbes Street. Branch offices: 9 East 41st Street, New York; New Smith Bldg., Russellville, Ark. Organized: May 21, 1927. Bus. vol. B. The original company was Booth & Flinn, Ltd., which was organized in April 13, 1893, and renewed April 12, 1913. On May 21, 1927, the entire assets of Booth & Flinn, Ltd., were purchased by George H. Flinn from the heirs of the late Senator William Flinn and a new company was organized on that date under the name of Booth & Flinn Co. Officers: George H. Flinn, President; George H. Flinn, Jr., Vice-President; William F. Hill, Vice-President; William J. Wiseman, Secretary and Treasurer. Major contracts: 1927, Armstrong Tunnels, Pittsburgh, $1,800,000; approaches to Liberty Tunnels and Bridge, Pittsburgh, $450,000; 1927-28, Fleming Park Road, Allegheny County, Pa., $600,000; Empire Gas Co. pipe lines in Texas and Oklahoma, $500,000; 1928, Sinclair Gas Co., pipe lines in Oklahoma, $300,000; Pennsylvania state roads, $500,000; Arkansas Gas Co., pipe line in Arkansas, $300,000; various street contracts for city of Pittsburgh, $500,000.

Cancelling a Cancellation

It is at best a dangerous thing for a contractor to announce to an owner that he will not go ahead with the contract. But, according to a decision of the Minnesota Supreme Court, handed down July 20, 1928, in the case of Johnson vs. Wright, 920 N. W. 946, the mere fact that a contractor has made such a declaration does not prevent his later choosing to go ahead with the contract, if in the meantime the owner has not taken any steps on the faith of the declared cancellation. Said the court:

"A contractor who has improvidently or unadvisedly refused to perform his contract may, before the other party has either manifested an election to rescind the contract or changed his position in reliance on the repudiation in such a way as to make performance more burdensome, retract the refusal and go on with the contract."

A 36-Ton Steam Shovel Plunges Through a Bridge

FOLLOWING the fining of both the driver and the owner of the 36-ton steam shovel which caused the collapse of a bridge on Trunk Highway No. 3 south of Hastings, Minn., recently and the filing of a civil suit for damages against the owner, the State Highway Department has announced that similar action will be taken against others who violate the law governing load limits.

The maximum weight of a vehicle with load permitted by law in Minnesota is 28,000 pounds or 14 tons. The maximum permitted on one axle is 22,400 pounds. This weight can safely be carried on the paved highway at all times and on other roads under ordinary conditions.

All of the bridges built in recent years in Minnesota are designed with an ample margin of safety above the maximum load of 14 tons. Thirty-two bridges on the trunk highway system built before the state took over the highways have lesser load limits. The bridge on Highway No. 3 which collapsed under the 36-ton load was restricted to 10-ton loads and was so posted at both ends of the bridge.

Construction Industry News

Alexander Milburn Co., Baltimore, Md., has announced the incorporation of the Milburn Sales Corp., and the Milburn Paint Spray Corp., to carry on the sales of the products manufactured by the parent company. The officers of the Milburn Sales Corp., are Alexander F. Jenkins, President and Treasurer, Edward P. Boyer, Vice President, Louis J. Herzog, Secretary, who with the following are directors of the corporation; J. Kemp Bartlett, R. Jenkins, M. Wunder and Clarence H. Hildreth. The officers of the Milburn Paint Spray Corp., are the same, except that Robert M. Zimmerman is Secretary.

Max A. Berns, Publicity Manager, Universal Portland Cement Co., Chicago, Ill., has been elected Chairman of the Advertising Council of the Chicago Association of Commerce, succeeding Homer J. Buckley who has served as Chairman for five years. Mr. Berns has been prominently identified with movements for winter building, fire-safe construction, grade separation and wider streets and roads.

Sullivan Machinery Co., 122 South Michigan Avenue, Chicago, Ill., has announced the election of Arthur E. Blackwood of Chicago, as President of the company, succeeding the late Frederick K. Copeland. Mr. Blackwood has been with the Sullivan Machinery Co., for 32 years, having been successively manager of its Eastern Sales Department at New York and later a Director and First Vice President.

International Combustion Tar & Chemical Corp., 200 Madison Avenue, New York, and 2500 South Robey Street, Chicago, Illinois, is the new name of the F. J. Lewis Mfg. Co., producers of coal tar products since 1887, and a subsidiary of the International Combustion Engineering Corp. The new company produces a complete line of coal tar products, including creosote oil, road tar and roof materials, under the brand name IN-CE-CO., at its plants located in Newark, N. J., Fairmont, W. Va., Dover, Ohio, Chattanooga, Tenn., Granite City, Ill., and Chicago, Ill. A new plant is to be placed in operation shortly at New Brunswick, N. J.

The American Cement Machine Co., Keokuk, Iowa, manufacturers of Boss cement mixers, pavers and hoists has announced the purchase of the Inland Construction Equipment Corp., of Keokuk, manufacturers of Mandt automatic dump bodies.

The Caterpillar Tractor Co., San Leandro, Calif., on January 11, put into effect a new set of prices that marked a reduction in prices of from $175 to $300 per unit, plus an adjustment between basic costs and Midwest factories. This is the fourth major reduction and the sixth actual reduction in Caterpillar prices in the last four years as a result of increased production and improved manufacturing facilities.

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., has announced that it has taken over and is now operating the Monarch Tractors Corp., as the Monarch Tractors Division, Springfield Works, of the Allis-Chalmers Mfg. Co. The manufacture and distribution of Monarch tractors will be continued at the Springfield, Ill., works.

The Johns-Manville Corp., New York, has purchased the assets and entire line of products of the Celite Products Co., Los Angeles, Calif. In addition to insulating products the Celite Products Co., has been a large producer of filtration materials, extensively used in sugar mills, oil refineries and sewage disposal plants. Celite for concrete, one of the newer uses of Celite, is already one of the large developments of this product, its primary function being that of increasing the workability of concrete.

The T. L. Smith Co., Milwaukee, Wis., has announced the purchase of the Kwik-Mix Concrete Mixer Co., Port Washington, Wis. The entire plant of the company at Port Washington will continue to be operated as heretofore with the exception of the business office which will be combined with the T. L. Smith Co., Milwaukee office. With the acquisition of the various Kwik-Mix models, the T. L. Smith Co., now has a complete line of mixers ranging from 2½-S size to the 112-S tilter.

The Jeffrey Mfg. Co., Columbus, Ohio, has purchased a controlling interest in the Galion Iron Works & Manufacturing Co., Galion, Ohio. It is reported that no immediate change in policy or personnel is being made and no change is in prospect for some time. The products and name of the Galion organization are being continued and all contracts hold.

McCarthy, Jones & Allen, Inc., 111 First Avenue South, Nashville, Tenn., has been appointed distributors for Sullivan portable and stationary air compressors, manufactured by the Sullivan Machinery Co., 122 South Michigan Avenue, Chicago, Ill. This company will also handle Sullivan rock drills, concrete breakers, clay spaders and portable hoists.

Hercules Motors Corp., Canton, Ohio, has announced that the Amtorg Trading Corp., New York, the authorized agents for the Soviet Government, has placed an order for several hundred power plants to be delivered over a period of ten months for equipping a fleet of trucks for service in Russia. The specifications call for the heavy-duty six-cylinder motors 4⅜ x 4¾ model which are used by many truck manufacturers in the United States.

The International Cement Corp., 342 Madison Ave., New York, has announced that the names of its domestic subsidiaries have been officially changed to the Lone Star Cement Co., of the state in which each company is located. This change directly identifies each company with its product, Lone Star Cement, and makes the subsidiary company name uniform throughout the United States. This change effects only the name of the company. There will be no change in the management, policy or products.

George Haiss Mfg. Co., Inc., New York, has announced the appointment of the following new distributors for Haiss truck loaders, belt conveyers, clamshell buckets, etc.; Holmes-Talcott Co., East Hartford, Conn., and West Springfield, Mass.; Contractors Equipment Co., J. J. Stockberger, Manager, Fort Wayne, Ind.; W. C. Caye & Co., Atlanta, Ga.; C. Taylor Handman Co., Cincinnati, Ohio.

Joe Beltz has been appointed Advertising Manager for both the Thew Shovel Co., Lorain, Ohio, and the Universal Crane Co., Lorain, Ohio.

Roger D. Edwards, who is acting as Vice-President of the new consolidation of the Ryan Manufacturing Corp., and the C. D. Edwards Mfg. Co., manufacturers of road building machinery, has resigned, effective March 1. Mr. Edwards has been in active management of the Edwards Co., for a number of years prior to the sale of his interest to the new organization.

Legal Points for Contractors

These brief abstracts of court decisions in the contracting field may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney

Edited by A. L. H. Street, Attorney-at-Law

Right of Contractor to Recover for Part Performance of an Abandoned Contract

A sidewalk contractor abandoning work without justification after making excavation, but before constructing any portion of the walk and curb, could not recover the value of work done, in absence of such acceptance thereof as to raise implied promise to pay for it, which cannot be implied from the mere fact that the owner of the land received benefit; he being powerless to return it. That is what the Connecticut Supreme Court of Errors decided in the case of Kelley vs. Hance, 142 Atl. 683, in an opinion handed down July 16, 1928. The court said, in part:

"While the plaintiff's contract was for the construction of a sidewalk and curb at a unit price per running foot, no section of the walk and curb was completed, and it is not claimed that plaintiff could recover upon the theory of a performance of a divisible portion of the contract; nor was he entitled to recover upon the theory of a substantial performance. This was in the nature of a construction contract as to which class of contracts the rule is liberally applied permitting a recovery where a contractor has deviated slightly from the terms of the contract, not willfully, but in good faith, and there has been a substantial performance of the contract of which the other party has received the benefit. . . . Here, however, not only is there no finding of substantial performance, but it appears from the finding that no portion of the sidewalk and curb was actually constructed by the plaintiff, who, after making an excavation along the front of defendant's premises, left the work and has not done anything since towards its completion. The court has found that the reasonable worth of the work done by the plaintiff was $158.00, slightly more than a third of the contract price, and that the defendant has benefited to that extent from the plaintiff's work. The case, therefore, is one where a contractor has without justification abandoned his contract before completion, but seeks to recover from the defendant the reasonable worth to the latter of the work done prior to the abandonment.

"Though a contractor has failed of performance for reasons which would not excuse a breach, and where there has not been even substantial performance, the breach being merely negligent, many of the more recent decisions have held that he could recover the value of his work, less the damages caused by his default. . . . Such recovery is allowed, not upon the original contract, for that has been breached, but in quasi contract upon the theory that, if such recovery were not allowed, the other party would be unjustly enriched at the expense of the contractor. . . . Some cases have gone so far as to allow an employee who has performed part of his employment to recover reasonable compensation, though his failure to render further performance was due to his willful abandonment of his contract. . . . By the weight of authority, however, there can ordinarily be no recovery where the contractor has willfully abandoned his contract without justification. . . .

"While the mere fact that part performance has been beneficial to the defendant [the owner] will not entitle the plaintiff [the contractor] to recover where he has abandoned performance without justification, the defendant may nevertheless make himself liable by his voluntary acceptance of the benefits under circumstances sufficient to raise an implied promise to pay for them not withstanding the nonperformance of the contract. Where one retains goods received in part performance of a contract, a promise to pay for them is ordinarily implied since he has the option either to pay for or return them. Where, however, work has been done upon one's land, the benefit cannot well be returned and an acceptance of the benefit cannot be implied from the mere retention of possession of the land. In such cases, therefore, the better rule would seem to be that, except where there has been an actual acceptance of the work prior to its abandonment by the plaintiff, mere inaction on the part of the defendant will not be treated as an acceptance of the work from which a promise to pay for it may be implied. . .

"We have held that recovery can be had for partial performance which has been beneficial only when the benefit has been appropriated by the defendant under circumstances sufficient to raise an implied promise to pay for the reasonable value of what has been received."

Extra Expense Resulting from Delay in Accepting Work Recoverable by Contractor

Acceptance of work completed by a contractor with the state of New York was delayed through delay of the state in awarding other contracts and in completion of the work called for under such contracts. This entailed extra expense for insurance, as well as loss of the use of the money due the contractor. Under these circumstances, the Court of Claims of New York, decided in an opinion handed down August 22, 1928, in the case of F. N. Lewis Co., Inc., vs. State, 230 N. Y. Supp. 517, that the contractor was entitled to reimbursement from the state for expense involved in renewal of insurance, necessitated by the delay. An allowance was also made to the contractor for interest covering the delay in accepting and paying for the work, which could not be tested until after completion of the work called for by the other contracts above referred to.

Pay for Materials Falling Into Highway Through Defect in Plan

A Washington highway contract entailed construction of a road along a Puget Sound bluff and litigation arose concerning the right of the contractor to pay for repairing a bulkhead on the water side of the road, and for removing material that fell into the highway from the embankment on the other side.

In an opinion handed down May 14, 1928, the Washington Supreme Court decided (Strong & MacDonald vs. King County, 267 Pac., 436) that because the break in the bulkhead was due to negligent movement of a heavy steam shovel by the contractor there was no right to recover the first item. But as to the other item, we read in the court's opinion:

"Whether the county is liable for the removal of the overbreak is a more troublesome question. The evidence does not show that the overbreak was due to the fault of the contractor. On the contrary, we think it very conclusively shows that it was due to the fault of the plans for the work. . . . To grade the bank to a slope at which it would stand required the removal of a large quantity of material in excess of that required by the terms of the contract, and, manifestly, no just reason can be urged which would require this to be done at the appellant's [contractor's] cost."

Court Awards a Contractor a Nonstatutory Lien

The law recognizes two kinds of liens, those that are conferred by statute—for example, an ordinary mechanic's lien—and those that are not recognized by any express statute but that will be decreed by a court to exist when justice would be thwarted if a lien were not recognized.

An excellent illustration of circumstances under which liens of the second class—"equitable liens"—will be decreed and enforced is afforded by the decision handed down July 6, 1928, by the United States Circuit Court of Appeals, Fifth Circuit, in the case of Town of Covington, La., vs Alonzo B. Hayden, Inc., 27 Fed. (2d Series), 360.

A construction company was awarded a contract by the town of Covington, La., to do certain work in connection with the installation of a sewerage system, to pay for which the taxpayers had voted a bond issue. A dispute arose, and the job was taken away from the company, and another contractor employed to complete the work. The bonds had been sold, and about $12,000 of the proceeds were still in the hands of the town treasurer. The company filed suit to impress the money remaining on hand with a lien in its favor, for an injunction to prevent its being paid out to others, and to recover on the contract, and for extra work, a total of $22,895.79. The town answered, denying that the company was entitled to a lien on the proceeds of the bonds, or any money judgment, and set up a counterclaim for $30,407.40, the cost of repairing and reconstructing the sewers.

The trial court awarded judgment in the company's favor for more than $14,000, but decided that it was not entitled to a lien. Reversing this conclusion on appeal the Circuit Court of Appeals said:

"There could be no doubt that the bonds disposed of were sold for the purpose of paying for the work to be done under appellee's contract, and that the proceeds were dedicated to that purpose, and not to the general uses of the town. We think, in these circumstances, an equitable lien was created on the proceeds of the bonds."

Rights of Nonresident Corporations

An individual contractor may roam the country over with the same right to engage in the contracting business in any state he pleases on the same terms that residents of that state may. Under the Constitution of the United States, an attempt to discriminate against him by local legislation because of his nonresidence would be void.

But not so with corporations. Primarily, a corporation has no legal existence in a state other than that in which it was organized. In other words, every state has a right to prescribe the terms on which corporations organized in other states may do business in that state. An exception to this rule applies to business of interstate character, for it is the exclusive province of Congress to regulate commerce between the several states. But the nature of building and construction work is such that the principal phases of such work are local and therefore within the jurisdiction of the laws of the state where the principal contract is to be performed.

Nearly all of the states, if not all, have laws which require nonresident companies to comply with certain formalities before they lawfully may do business in the state. These formalities usually include filing with the secretary of state a copy of the corporation's articles, designating some one on whom legal process may be served, and paying a license fee. Penalties for noncompliances with these requirements vary in different states. In some jurisdictions, the noncomplying company merely subjects itself to a money penalty; in others, its contracts in the state become void.

The question as to who may take advantage of a foreign corporation's failure to secure a permit to do business in a state was recently raised before the Oklahoma Supreme Court in the case of M. S. Cohn Gravel Co., vs. Southern Surety Co., 264 Pac. 206.

The gravel company was an Arkansas corporation operating pits in Oklahoma. It sold gravel to a highway contractor residing and doing business in Oklahoma. He failed to pay for the same in full, and the gravel company sued his surety. The surety company pleaded the gravel company's failure to comply with the laws of Oklahoma governing nonresident corporations as a defense. The court decided that if the contract for the sale of the gravel was made and performed at a time when the gravel company had not been licensed to do business in Oklahoma, the contractor could have justified his refusal to pay, even though the company did procure a license before bringing suit. But the contractor interposed no such defense, and the court held that thereby the defense was waived and was not available to the contractor's surety.

Written Contract Merges Previous Negotiations

"I know it is not in the contract, but you remember that before we signed the contract we verbally agreed to it." A contractor is talking to the owner, and they are having a controversy all because the contractor did not see to it that his written contract embodied all of the important terms of the agreement. If it happens that the omitted agreement is covered by a letter written by the owner, the contractor may feel that he is just as secure as if the agreement had been embodied in the written contract. But this is not true if the letter was written before the final contract was drawn up and signed, unless either the written contract does not purport to cover the whole agreement of the parties, or unless it can be shown that through mutual mistake or fraud of one of the parties the written agreement fails to embody the omitted term.

The North Carolina Supreme Court in the case of Porter & Peck vs. West Construction Co., 142 S. E. 27, decided March 21, 1928:

"Ordinarily a written contract merges antecedent correspondence and written instruments of prior date."

Surety Company Loses Claim of Right to Extra Premium

A contract called for the building of two bridges on a state highway project and the contractor gave a statutory bond covering the same. Later a "work order" was given the contractor to build two additional bridges on the same project but not contemplated by the original contract. The surety company that issued the bond later claimed an extra premium for supposed overrun under the contract.

In an opinion handed down June 22, 1928 (National Surety Co. vs. Erler, 220 N. W. 543), the Minnesota Supreme Court decided that the premium was not recoverable—that the agreement embodied in the order for the two additional bridges amount, not to a change or modification of the original contract, but to a new and independent contract. The court tested the surety company's right to an extra premium by the point whether or not it would have been liable as to the two additional bridges, and concluding that no such liability could have been enforced against it.

Effect of Contract Provision Requiring Written Authority for Changes

In a case involving state highway construction (Snowball vs. Maney Brothers & Co., 270 Pac. 167), decided by the Wyoming Supreme Court September 11, 1928, the court dealt with the effect of a clause in the contract, providing, in substance, that allowances for extra and additional work would not be made unless supported by written orders signed by the engineer. The court ruled that such a provision must be regarded as a protection of the state against unwarranted claims by the contractors, and as being inapplicable to claims by a subcontractor against the principal contractor. The opinion also recognizes that such clauses are subject to waiver or modification by subsequent oral agreement between the parties to the contract in which the clause appears.

Dual Wheels for Light Trucks

THE Van dual wheels for the Chevrolet 1-ton truck, which are manufactured by the Erie Malleable Iron Co., Automotive Wheel Division, Erie, Pa., enable the operator to carry four 30 x 5 tires on the rear instead of two, thus doubling the carrying capacity.

A 30 x 5 tire has a capacity of 1,575 pounds, so that four such tires will carry 6,300 pounds, dead and payload on the rear. They give greater traction, and since they cover more ground surface they can easily pull out of rough, uneven ground or roads.

Van dual wheels for Chevrolet are furnished with four 30 x 5 Firestone DT rims and all rim parts, and are drilled to take the standard rear Chevrolet hubs and brake drums. If it is desired that front wheel rims interchange with the rims used on the Van dual wheels, the manufacturers suggest mounting rear Ford truck wheels on the front of the Chevrolet. It is, of course, not necessary to change the front wheels, as no spare is needed for the rear wheels. Any three rear tires will carry the load a reasonable distance.

The Van Dual Wheel for the New Chevrolet 1-ton Truck

A Truck Mounted Cylindrical Concrete Carrier

AFTER an exhaustive investigation the Autocar Co., Ardmore, Pa., has announced that it has adopted the Good-Roads concrete truck for mixed-in-transit concrete service. Strength and simplicity are the dominant factors in the design and construction of this carrier, which is a cylindrical steel tank, whose inside walls and ends are perfectly smooth and entirely free of flights, supporting shafts or obstructions of any kind. The carrier is built in two sizes, with capacities of 1½ and 3 cubic yards.

After loading, the carrier is hermetically sealed and slowly revolved until ready to discharge. The rolling action eliminates all segregation and causes more complete hydration. It is thus possible to deliver the batch on the job as long as three hours after loading at the central plant in exactly the same consistency it was when discharged by the mixer.

The tank, supported at each end by large trunnion shafts, revolving in heavy-duty self-aligning roller bearings, is revolved by a cut steel pinion engaging with a gear attached to the outer circumference of the tank surface at the front end.

Instead of being powered by the motor truck, power for the carrier is furnished by an 8 h.p. Le Roi 2-cylinder motor with throttle control. Clutch and gears operate within a single casing integral with the engine housing and running in an oil bath. The power is transmitted from a sprocket on the gear shaft, through a chain drive to a corresponding sprocket on the pinion shaft, which is supported in two self-aligning ball bearings.

The Autocar Good Roads Concrete Carrier

The Autocar truck on which the carrier is mounted is a 5-ton, 6-cylinder, 162-inch wheelbase chassis.

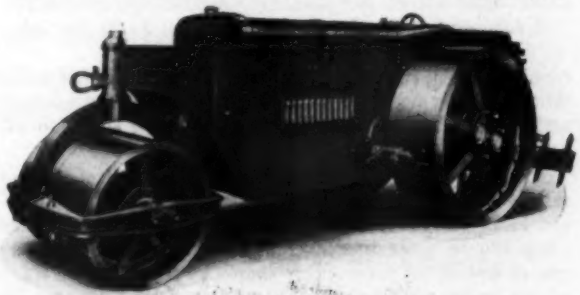
A 10-Ton Road Roller with a 6-Cylinder Motor

A BRAND-NEW motor road roller containing many new features has been developed by the Ames Iron Works, Oswego, N. Y. The roller frame consists of reinforced steel plates ½-inch thick extending from the front roller yoke to the extreme rear. They are extended beyond the rear rolls to carry the scarifier attachment, and are cross braced at several points for rigidity. The wheel base is 120 inches and the overall width 78 inches. The length, including the scarifier, is 209 inches.

The Ames roller is powered by a 6-cylinder 60-horsepower Hercules engine with positive pressure lubrication, a circulating water pump, Modine radiator and is connected to the transmission with a Twin Disc clutch.

The control for forward and reverse movement is a single lever with the lever handle position showing the direction.

The front roll is made in two sections 36 inches in diameter



The New Ames Road Roller

with a total width of 44 inches. It is constructed of a semi-steel casting with rolled wrought iron spokes cast into the hub and rim. The face of the roll is machined smooth. The rear rolls are constructed the same as the front rolls, except that each is a single section 60 inches in diameter and 20 inches wide. Each rear roll is fitted with lugs to be used when scarifying and taper plugs for these holes when rolling. The rear roll overlaps the front roll 3 inches on each side.

The scarifier consists of a clutch-operated air compressor with an air tank. There are two air cylinders mounted vertically directly over the scarifier bar. The angle at which the teeth are set, together with the long drawbar employed, makes it possible to hold the scarifier down with very little power.

New Drainage Pump Operated by Outboard Motor

A NEW type drainage pump which is powered with a Johnson outboard motor and which is unique in that it is self-priming and will shut itself off when the supply of water to be pumped is exhausted is manufactured by the Johnson Motor Co., Waukegan, Ill.

This pump consists of a long pump shaft with a light twin cylinder outboard motor mounted on the top. This motor powers the impeller which is located at the bottom of the shaft. As the pump shaft sinks to the bottom of the water, the impeller is always submerged and cannot suck air while there is still water to be pumped. This arrangement eliminates the necessity of priming the pump and since the pump is already primed, the water begins to flow immediately after the motor is started.

A simple automatic shut-off safeguards the pump against possibility of burning out on the job. This safety device short circuits the magneto when water is not passing the diaphragm, due to clogging or any other cause, thus protecting the motor from burn-outs. It also permits the operator to go to other parts of the job since the pump automatically shuts off when there is no more water to pump.

To start the motor it is necessary to insert a key into the shut-off, which is electrically connected with the magneto. This breaks the short with the primary of the magneto and permits the motor to operate. As the water passes up the casing it deflects the diaphragm of the shut-off and compresses a rustless spring which releases the key while the short in the primary

A Johnson Self-Priming Drainage Pump is Easily Carried

remains broken, permitting the motor to remain in operation. When there is no more water to be pumped, the pressure against the diaphragm is relieved, allowing the spring to expand and make contact.

The pump is made in three different lengths, 8 feet, 11 feet and 14 feet. It will pump 195 gallons of water per minute and 1,000 gallons for the approximate cost of one cent. The pump can be made to deliver in exact accordance with any rate of flow in the water supply simply by regulating the speed of the motor. The motor speed is controlled by the gas throttle and spark.

The power plant of this portable self-priming drainage pump is the Johnson light twin motor. This is a three-port, two-cycle gasoline engine of advanced design which develops 2 horsepower at 2,100 r.p.m. The motor is equipped with a patented, waterproof, quick action, flywheel magneto of extra large size. Vibration is practically eliminated by the simultaneous firing of the two cylinders which are directly opposed. The force of one explosion counteracts the other.

This Johnson pump, which weighs 85 pounds, can be used on a variety of jobs, including pumping water from excavations, concrete forms, manholes, barges, and dredging of all kinds. Because of its light weight, it can be easily transported from one job to another.

The New Thor 250-foot Portable Air Compressor

A Portable 250-Foot Air Compressor

A NEW Thor 250-foot portable air compressor, which under actual test delivers 210 cubic feet of air per minute has recently been announced by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. This compressor is equipped with the patented Rix supercharger which enables the piston on its idle or downward stroke to compress the additional air the Thor delivers, thus increasing its efficiency.

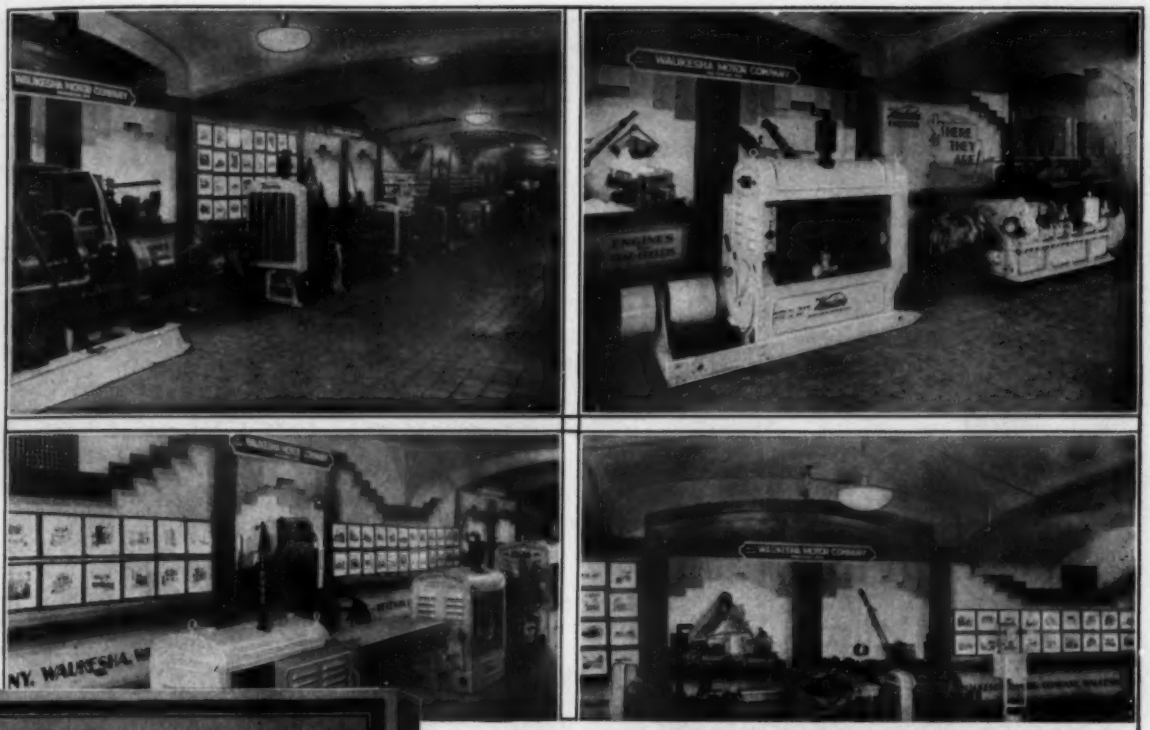
It is direct driven. It has no clutches, couplings or gears. This design makes for simplicity and low upkeep cost. The compressor is low slung and exceptionally well balanced, reducing vibration to a minimum. All working parts are easily accessible. The bore is 7½ inches and the stroke 7 inches. The length overall is 10 feet 10½ inches and the height overall 6 feet 4¾ inches. The Thor may be had in a variety of mountings to suit individual requirements.

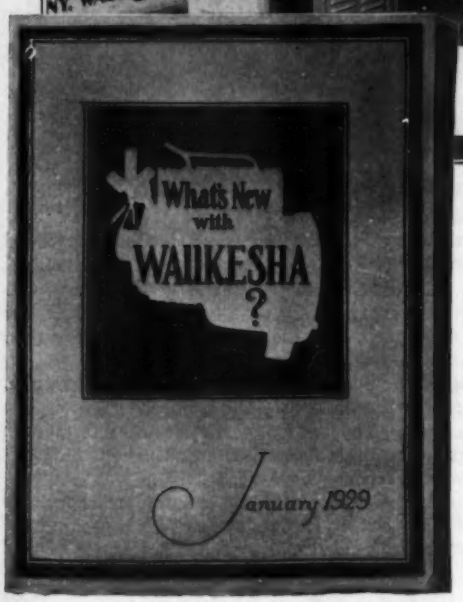
Another Thor model, 116-foot, which delivers 96 cubic feet of air per minute, has similar design and construction throughout.

A Light-Weight High Grade Hand Shovel

A HAND shovel is a comparatively small tool, particularly when compared to the big power units which are seen on practically every construction job, yet a great deal of time and energy can be lost through the use of poor hand shovels or those which wear out rapidly. Baldwin Tool Works, Parkersburg, W. Va., are offering the Monongah Featherweight Brand shovel to meet the demand for a high grade lightweight tool. The blades are forged from special shovel steel of high strength. The straps are forged from soft steel, thus insuring strength at the most vital part of the shovel, namely at the bend. They are rolled flush with the handle, eliminating the possibility of protrusion. The handles are made of carefully selected Northern ash hay fork stock, sanded and waxed. The shovels weigh approximately 46 pounds per dozen.

Baldwin Tool Works, Parkersburg, W. Va., are not only selling these shovels direct but are offering them to and through distributors.





1929 Road Show

The Road Show at Cleveland, in January, brought forth the best that the most prominent builders of contractors' machinery have been able to develop for the 1929 demand. Shovels, cranes, skimmers, rollers were all attractively displayed for contractors, commissioners and others interested in the making and repairing of roads.

The Waukesha Motor Company was present with a showing of nine new models, including the season's outstanding development, The Great Six. This engine and other new Waukesha models are fully described in the Bulletin, "What's New with Waukesha?"

For the contractors and machinery manufacturers who did not attend the show, bulletin No. 710, "What's New with Waukesha?" is available upon request. This 20-page bulletin describes and illustrates the new Waukesha engine models for both automotive and industrial use. Write for your copy.

"L-Head Engines—they take better care of themselves."

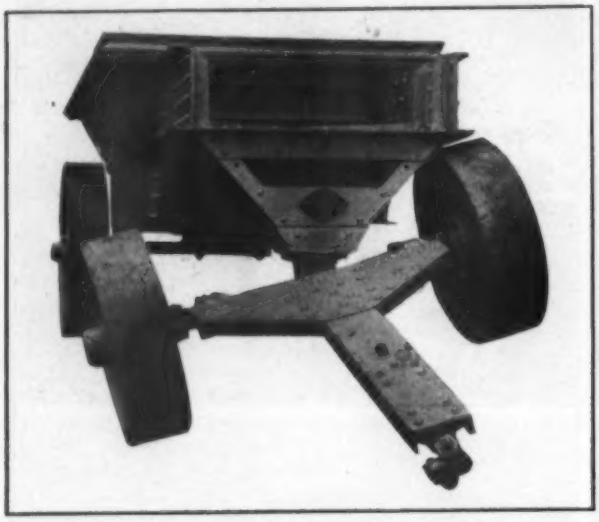
918

INDUSTRIAL EQUIPMENT DIVISION

WAUKESHA MOTOR COMPANY

New York Tulsa **Waukesha, Wisconsin** Houston San Francisco

Exclusive Builders of Heavy-Duty Internal Combustion Engines for Over Twenty Years



Front View of a 5–6½ cubic yard Smith Trailer, Showing Spring Draw Bar

Bottom-Dump All-Steel Tractor-Drawn Trailers

THE hauling of excavated material on construction jobs over all ground conditions is one of the many problems facing general contractors. Tractor-drawn bottom-dump trailers built by the Smith Trailer Corp., Syracuse, N. Y., are of various sizes, of 3-, 5-, 8- and 10-yard capacities, water level, and mounted on disc wheels and creeper wheels.

The 3-yard model R3 has 6-inch tired disc wheels. The 5-yard model R5 has 10-inch tired disc wheels. Model C5, a 5-yard semi-trailer, is mounted on creeper wheels and the C8, an 8-yard body, has 10-inch disc wheels in front and 10-ton creeper wheels in the rear. The C10, a 10-yard body, is mounted on 10-inch disc wheels in front and 15-ton creeper wheels in the rear. Model R3 has a round load capacity of 4 yards, R5, 6½ yards, C5, 6½ yards, C8, 10 yards and C10, 13 yards, respectively. Smith trailers have a heavy duty spring drawbar and all connections for hauling trailers in train are standard equipment.

An Improved Bin and Measuring Device

THE measuring of concrete aggregates by weight is rapidly increasing in favor. The Heltzel Steel Form & Iron Co., Warren, Ohio, has developed a new Duplex Weighing Agrabatcher with a hopper bottom in two compartments and amply large enough to hold the quantities of materials necessary for the ordinary batch used in road and other types of construction work. The capacity of the stone compartment is 3,000 pounds or approximately 31 cubic feet and the sand compartment has a capacity of 2,000 pounds or approximately 20 cubic feet.

The Heltzel Duplex Agrabatcher is equipped with an American Kron automatic springless dial scale having a 36-inch dial graduated to 5,000 pounds by 5-pound graduations. The dial is mounted on a special structural steel support which is carried to the outside members of the bin and is equipped with pointers which can be set to any desired position on the rim.

The weights of the materials are predetermined and the pointer then set at the weights of the stone and sand and a third pointer set at the weight of the combined batch of sand and stone. The operator may then either weigh sand or stone separately, weighing one batch and then the other, or he may weigh the batch of sand and stone together, first weighing either sand or stone by bringing the hand opposite the pointer as set for the material which he happens to weigh first and then weigh the amount of the other aggregate by bringing the hand to the pointer as set for the combined weights of sand and stone. The advantage of this scale is that it eliminates the necessity for making adjustments of counterweights or poises as is necessary with a beam scale. The dial being 3 feet in diameter makes it possible for the inspectors on the job to see at a glance exactly what the weight of any batch may be. The hand on the dial automatically returns to zero and the operator or inspector is able to check the scales for every batch in an instant.

The New Heltzel Duplex Weighing Agrabatcher

A Lightweight Portable Pumper

A LIGHT, compact, portable pumping unit, designed for unwatering excavations, cofferdams, trenches, subways, conduits, barges and scows, has been developed by the Pennsylvania Pump & Compressor Co., Easton, Pa. This Penroi pumper has the pump and gasoline engine assembled into one unit, mounted on a hand truck chassis. The pump is of the centrifugal single-suction open-impeller type, with 3-inch discharge and 4-inch suction openings.

The casing of the pump is of cast iron, of the volute type, and can be adjusted so that the discharge opening has any one of eight positions. The suction nozzle is cast integral with the casing and companion flanges are furnished for both suction and discharge openings.

The pump head is of cast iron, accurately machined and carries the stuffing box, which is provided with a bronze water seal cage, a cast iron gland and a sufficient quantity of good

The Penroi Portable Centrifugal Pumper

Ransome for Low Equipment Cost

120 foot Ransome Monkey-on-a-Stick plant with 384 feet of continuous line chutes pouring bridge piers.

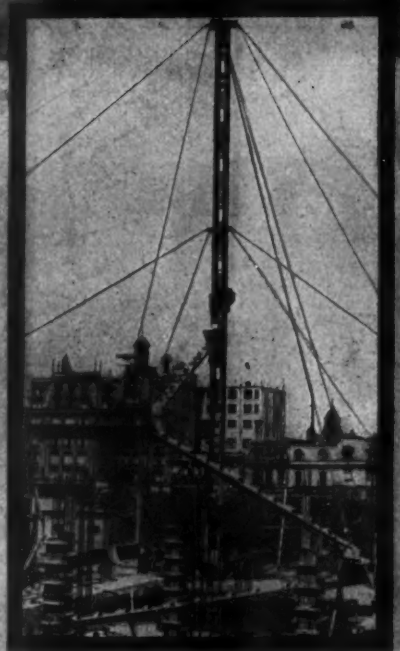
These photos show two jobs on which the cost of the equipment required *to handle the concrete economically is very low.*

◆ ◆ ◆

If you have concrete to place maybe we can save you money. Isn't our 79 years of experience worth something? It is yours for the asking.

◆ ◆ ◆

Many a contractor in all parts of the world has found it well worthwhile. You might.



105 foot Ransome Monkey-on-a-Stick Plant with boom counter-weight chute plant pouring Mexican Government Building.

Ransome Concrete Machinery Company

Dunellen — Service for 79 Years—1929 — New Jersey

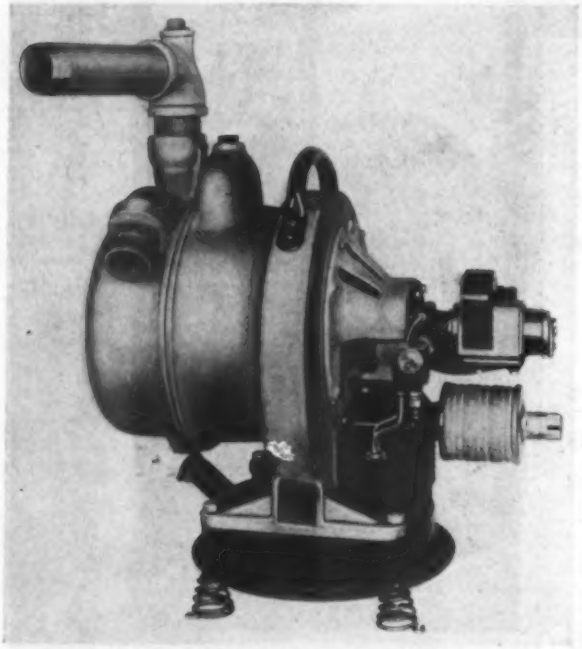
grade packing. A grease cup lubricates the packing and is placed immediately above the water seal cage. A bronze sleeve covers the engine shaft, through the pump stuffing box, to prevent excessive corrosion and wear of the shaft, and to allow for simple inexpensive renewal.

The impeller is of the single suction type, made of special bronze to withstand corrosion, is carefully machined, accurately bored and tested for balance. The impeller and shaft bushings can be removed by taking off the pump casing, without disturbing the adjacent parts, or the engine alignment. The pump casing is a separate unit bolted to the main frame. Clogged passages may be easily cleaned when necessary because of this ready access to the interior parts of the pump.

For average field conditions, the manufacturers recommend this unit for heads from zero to 45 feet total head. It will deliver varying quantities of water up to 350 gallons a minute, with a 5-foot suction lift. This pump is powered by a LeRoi, two-cylinder, eight-horsepower, radiator-cooled gasoline engine.

A Portable Self-Priming Centrifugal Pump

A TWO-PURPOSE pump suitable for pumping volume up to 6,000 gallons per hour as well as for seepage has been developed by the Homelite Corp., Port Chester, N. Y., in the Homelite portable self-priming centrifugal pump. This pump is operated by a Homelite air-cooled gasoline engine built into the pump. Spring feet on the base take up the engine vibration and eliminate the need of skids or other foundations. The complete unit, engine, pump and fuel tank,



The Homelite Self-Priming Centrifugal Pump

weighs but 75 pounds and a conveniently located handle makes it readily portable by hand by one man.

The self-priming feature has been achieved without the use of vacuum apparatus or auxiliary mechanism and eliminates the need of a foot valve on the suction line. This is a centrifugal pump with a bronze open-type impeller. The gasoline engine is the same which has been on the market for a number of years and used for the operation of Homelite generators and pumps. Oversize ball bearings are used on the main shaft and ignition current is supplied by a high tension waterproof magneto.

An Improved Sheave-Block for Scrapers

AN improved item of equipment which is of interest to operators of power drag scrapers is the new type of sheave-block known as the Durolite dragline block and manufactured by Sauerman Bros., Inc., 464 South Clinton Street, Chicago, Ill. These blocks are made in a wide range of sizes equipped either with bronze bushings or with roller bearings. The bushed blocks have solid phosphor bronze bushings with two grease ports connecting with the grease reservoir, and the sheave revolves on a case hardened steel sleeve so that there is little wear on the axle. The sleeve is easily renewable. The roller bearing blocks have the standard Sauerman-Timken roller bearings.

Sauerman Durolite Sheave Block With Swivel Hook Attachment

Among the improved features of the Durolite blocks are the frames which are of cast steel of an analysis and heat treatment which varies with the different sizes of blocks to produce the necessary strength with the least possible weight of casting. The frames are of open construction. The flanges of the sheaves are protected by a heavy bead on the housing, which prevents the rope fouling the sheave and protects the rope. There is no contact between the sheave and the frame in any of these blocks. By removing one pin from the yoke, the side of the housing can be opened up for removal of the bight of the rope. Consequently the operating cable need not be threaded through the block, thus saving time in replacing cables or changing the set-up. Blocks can be completely taken apart with a small wrench but it is impossible for the axle to become loose as the nuts are recessed into the housing.

The sheaves of all sizes are of the same grade of heat treated alloy steel, machined before heat treating. Bearings, both bronze and roller, are designed to take the end thrust as well as radial pressure. Lubrication is provided through the sheave and a grease reservoir is provided around the bearing in both the bushed and roller bearing types. Provision is made for supporting or counterbalancing the blocks when operated in positions where convenient to do so. In a laboratory test for strength, one of these Durolite blocks withstood a pull of several times the load that this particular size of block was designed to carry.

Four sizes of bronze bushed blocks with sheaves 12 inches to 18 inches in diameter and six sizes of roller bearing blocks with sheaves 16 inches to 36 inches in diameter are manufactured for standard power scraper installations. In addition, two smaller sizes of bronze-bushed blocks with 8-inch and 10-inch sheaves are manufactured for special uses. The blocks are furnished with either a pin-bearing swivel eye, a rope-bearing swivel eye or a swivel hook, depending upon the requirements of the user.

1929 to Be Banner Road Year

With the increased money available for highway construction in practically all states from the gasoline tax and additional bond issues now available 1929 will be the biggest year of road-building in history. Contractors who will profit will be those who carefully select their organization and the proper construction equipment.

LaBOUR PORTABLE

Centrifugal Self-Priming PUMPS with Gasoline Engine or Electric Motor Drive

Actually Pump AIR!

CONTRACTORS all over the country are enthusiastic about LaBour pumps. For these pumps take care of conditions that no other pump ever handled for them.

1. They actually pump *air* when exhausting an empty suction line.
2. They handle dirty water and sewage.
3. A 20 ft. suction lift is *guaranteed*, at approximately sea level.
4. Pumping capacity is extremely large.
5. Simplicity of design and sturdiness of construction gives them exceptionally long life.

LaBour pumps are *dependable*. They keep on pumping without a murmur when ordinary pumps would break or stall.

Novel in Design

These pumps have no internal valves, no external priming attachments, no floats or any of the other familiar priming accessories.

One moving part—the distinctive LaBour IMPELLER—not only makes all those complications unnecessary, but takes care of air and dirty water conditions as no other pump, with whatsoever makeshift devices, can do it.

Uses Are Many-Fold

These pumps are found ideal by contractors for dewatering excavations, trenches, cofferdams, etc. There seems to be no "hard jobs" for them. They meet changing and "surprise" conditions in a way that has brought us a host of "thank you" letters from their users.

Sizes and Styles

Built in all sizes from 2 to 28 B. H. P.; 40 to 500 gals. per minute. Gasoline engine or electric motor drive.

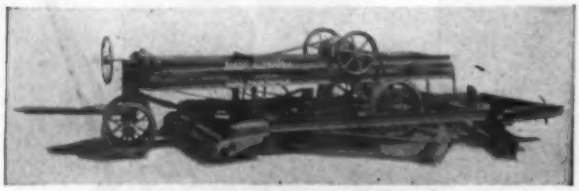
When you write for circulars, mention size and type you have in mind.

THE LaBOUR COMPANY, Chicago Heights, Illinois

A One Man Automatic Road Maintainer

THE one-man automatic road maintainer exhibited for the first time by the Baker Manufacturing Co., Springfield, Ill., at the 1929 Road Show is a multiple blade machine with rope control from the tractor driver's seat. The blade sections are so arranged that the dirt is carried across the road four times in one trip, filling up all ruts and low places.

By pulling one rope the tractor driver can cause the blade to rise slightly, or to full height for controlling the depth of the cut, or for raising the blades in crossing bridges, or when



The Baker One-Man Automatic Road Maintainer with Scarifier Attachment

turning around. By pulling the other rope, the blade section can be instantly lowered. The rope control is operated through clutches on the rear wheels and permits fine adjustment of the cut while the maintainer is in motion. Hand wheel control is provided for operating the blades when the maintainer is stationary. The four wheeled construction permits turning the entire machine around in a 16-foot road without backing up.

The Baker maintainer is made in two widths, 9 and 12 feet. They come with either steel or rubber tired wheels, the latter being equipped with Hyatt roller bearings. A scarifier attachment with manganese steel teeth can be furnished with either model.

A New Asphalt Patching Plant

AN asphalt street repair unit or patching plant, known as Model H-1 and designed to meet the need for a patching plant with modern oil burners at a moderate price has recently been announced by the Chausse Oil Burner Co., Elkhart, Ind. This new model has many of the features of the Chausse Model E-3 engine-equipped self-propelling outfit but is built to be operated independent of any large stationary plants which can not be operated economically on small yardage. It is a hand mixing plant designed for use directly on the street and contains many improvements.

As shown in the accompanying illustration, the plant is self-contained and is mounted on steel wheels, with roller bearings and 32- x 5- inch solid rubber tires. It has a towing tongue for ready attachment to a motor truck or tractor. At the front is a tool heating compartment, lined with fire brick and asbestos with a steel grizzley on which to place the tools, and equipped with a Chausse oil burner.

In the next section is located a tar kettle with a capacity of 150 gallons. This has an oil burner underneath which makes possible an initial pouring in from 15 to 20 minutes and will melt the entire capacity in about 45 minutes. The tar is conveyed through a 2-inch pipe to a measuring trough at the rear. Under the tar kettle is a large compartment for tools and accessories, including a machine-type hand pressure pump for putting air pressure on the fuel tanks. In this space also can be kept the Chausse 3-gallon hand torch supplied for pre-heating the burners and for warming cold joints, drying patches and other uses.

At the rear of the body of the machine are three storage bins, one for stone and one for sand with capacities of 1 cubic yard each, and one for stone dust or chips with a capacity of 10 cubic feet. These bins discharge upon a large drying and mixing pan. Under this pan is a chamber into which point three Chausse burners with ample capacity for quickly drying normally damp aggregate. When the aggregate is dry and heated to the proper temperature the asphalt is added from the measuring trough, stirred up by hand and dumped into a wheelbarrow.

Under the center of the machine are located two steel tanks for kerosene with a capacity of about 60 gallons, sufficient for a day's run, with an air pressure gage. The entire machine is built of steel, hot riveted and welded throughout, with ample structural capacity for the service intended. The axles are of alloy steel.

A large number of contractors and city officials have found a need for a complete but moderately-priced patching plant with sufficient capacity for their lesser needs and it was to meet this demand that this Model H-1 has been put on the market.

An Improved Wheelbarrow with Channel Iron Legs

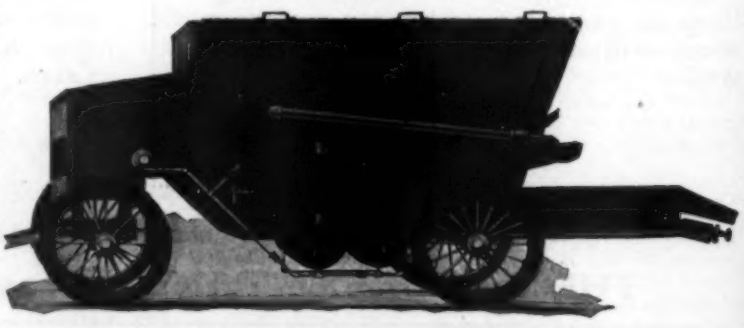
A WHEELBARROW designed especially for general contractors' work and which is balanced so that two-thirds of the load is carried over the wheel, has been announced by the Lansing Co., Lansing, Mich. The steel tray is 26 inches wide and 34 inches long with a capacity of 3½ cubic feet dry measure. The handles are of clear hard maple. The wheel, 15 inches in diameter, has a 1¾-inch tire and revolves in a steel bushing. The axle is of the never-slip type being screwed into the wheel bearings.

The legs of this wheelbarrow are of channel iron guaranteed not to bend and are in one unit. The frame is reinforced and tied together by channel iron crossbars having a dumping guard at the end of the handle for reinforcement. The tray brace in front is of channel iron, reinforced to prevent bending.

San Francisco Toll Bridge to Be Opened March 1

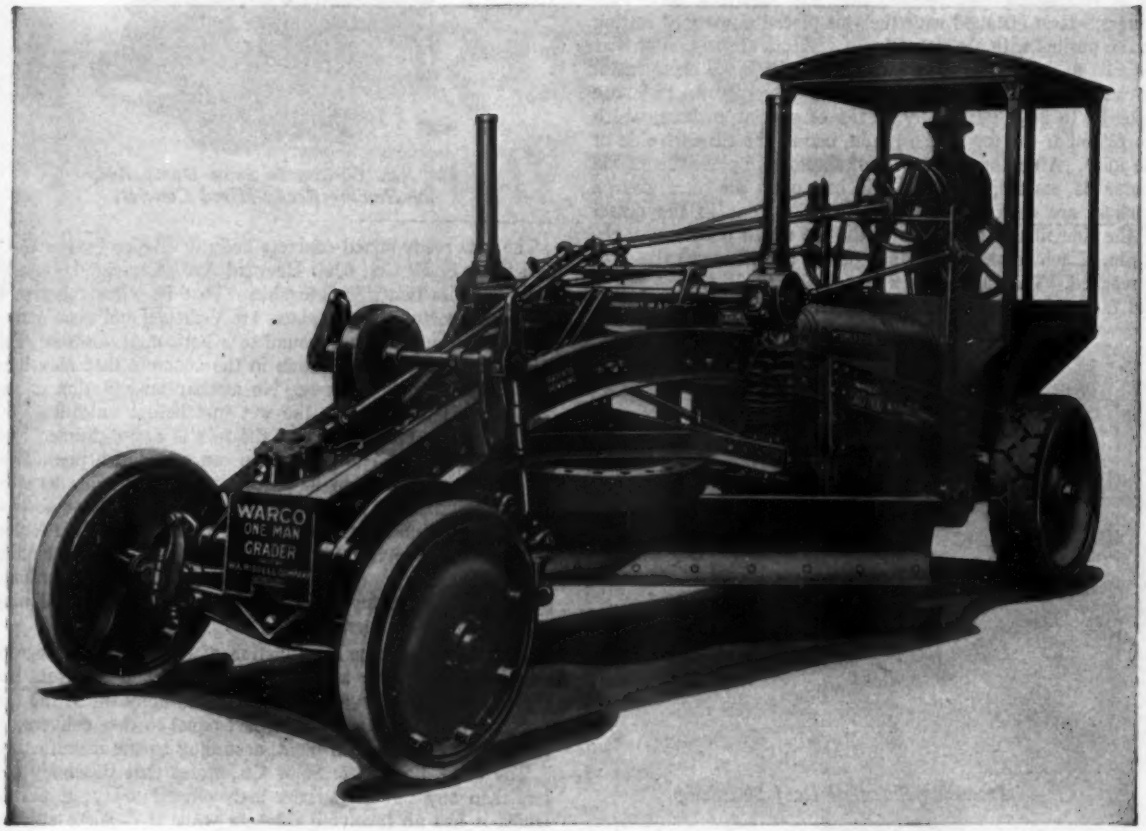
THE San Francisco Bay toll bridge connecting San Mateo and Alamedo Counties, Calif., is practically completed with construction approximately 137 days ahead of schedule, so that March 1 has been set as the date when the bridge will be commissioned for service.

This bridge, described in CONTRACTORS AND ENGINEERS MONTHLY for December, 1928, is the longest highway bridge in the world, measuring 7.1 miles from shoreline to shoreline with the western approach from San Mateo measuring 3 miles and the eastern approach from Mt. Eden 1.75 miles.



The New Chausse Asphalt Heating and Patching Plant

NEW 1929 WARCO ONE MAN GRADER



FAMOUS OVER NIGHT

- - - and justly so

The W. A. Riddell Company's exhibit at the Road Show—the new improved one man Grader—the new rear crawlers—the new 1929 Allcatrac, prompted enthusiastic expressions of commendations on all sides.

This unprecedented reception is a forerunner of the inevitable success of these machines. Their popularity is assured.

The new 1929 Warco one-man Grader with newly designed circle and new screw lift (patent applied for) has many excellent features which place it far ahead of any other Power Grader. Subjected to strenuous tests under every possible condition, the Grzder has proved its worth. Six months ago it was ready for production. In order to be able to introduce a new one-man Grader which would be the acme of perfection, the machine has been withheld from the market until its perfection was an absolute certainty.

The new 1929 Warco one-man Grader is now under production—it will be available for spring delivery—complete specifications and prices furnished on request.

See us at the Southwest Road Show and School, Witchita, Kansas, Feb. 15th-March 1st, 1929. Space No. 109 and 113.

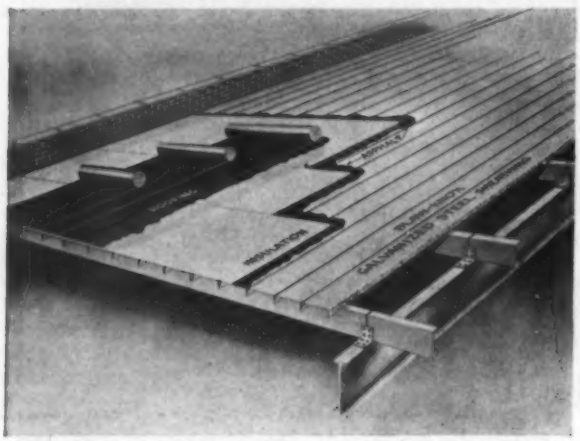
WARCO PRODUCTS DO THE JOB—EASILY—QUICKLY—EFFICIENTLY

W. A. RIDDELL CO.

Dept. F **BUCYRUS, OHIO**

Steel Sheathing for Roofs

A STEEL roof sheathing known as Blawsteel has recently been developed by the Blaw-Knox Co., 667 Farmers Bank Bldg., Pittsburgh, Pa. This sheathing is light in weight, strong, fireproof and impervious to dampness. It consists of galvanized sheets of steel with longitudinal, integral reinforcing ribs pressed into the sheathing on 4-inch centers. It is installed with the ribs placed downward resting on the purlins with the flat side up. Sheets are so placed that the ribs fit into grooves in a wood filler within a sheet metal galvanized eave cornice. As sheets are placed, they are fastened to eave purlins by means of special anchors, which are placed at the toe of the purlin, one in the rib each side of the joint. After the first course of sheets is in place the second course is started, lapping 3 inches over the first course. Anchors are then placed, each 10 inches, one in the center of the side ribs of all sheets at the lap which occurs over the purlin. Each course of sheets is placed likewise until the ridge is reached. Then a 12-inch x 10-foot long ridge cap is placed and fastened to the sheets with metal screws.



Installing Blawsteel Roof Sheathing

Standard Blawsteel sheathing will carry a roof load of 65 pounds per square foot on standard purlin spacing with a factor of safety of four, with less than allowable deflection for plaster ceilings. It will carry 100 pounds per square foot with only 3/16-inch deflection.

Standard purlin spacing is 3 feet 10½ inches but Blawsteel sheathing is furnished in 20, 22 and 24 gage so that the same roof load can be carried over greater spaces between purlins.

Blawsteel sheathing is light in weight, reducing the dead load to be carried on the structural steel framing and consequently reducing the weight of the trusses, purlins and columns.

This sheathing can be insulated against heat loss or penetration to any degree desired, with any good insulation having the correct ratio of thermal conductivity.

It may be installed any time of year and the roof completed without regard to weather conditions, as being made of galvanized sheet steel it does not absorb moisture and needs only to be swept clean and dry before mopping for the application of insulation and roofing.

A New Truck Body for Ready-Mixed Concrete

THERE is probably no one thing in the construction industry today that is attracting the attention of as many people and being investigated as thoroughly as the problem of delivering concrete to the job on which it is to be used ready to pour into the forms, or, in other words—ready-mixed concrete.

The New Bartlett & Snow Dump Body for Hauling Ready-Mixed Concrete

The new ready-mixed concrete body developed by the C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland, Ohio, is made with its two sides movable. That is, when concrete is being transported the side plates are V-shaped and upon arrival at the job, the plates are wound to a horizontal position. This action corrects any segregation in the concrete that may have occurred during the journey. No mechanical agitation of any kind is used to condition the wet mix before unloading.

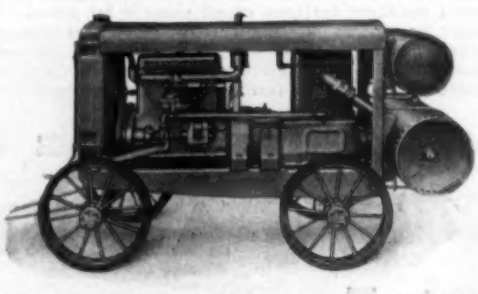
The body is then tilted and the mix is again churned as it passes through the end gate. The concrete which pours from the tail piece is said to be as plastic and workable as when it left the mixer. There are no mechanical baffles or obstructions of any kind inside the Bartlett-Snow body. This feature makes it suitable for the additional duty of general hauling. With the sides in a vertical position, it forms an ordinary rectangular end dump body in which sand, gravel and other materials may be carried.

This body performs the function of correcting any segregation in the concrete and tests taken at wide intervals have shown that the concrete delivered in the body up to the time limit set by cost is in every respect equal to that delivered by the mixer at the central plant, according to the manufacturer.

The C. O. Bartlett & Snow Co., states that this body costs less than any similar purpose body offered today; it fits any truck, it has no revolving parts to wear, it requires only one minute to correct separation and dump the load upon arrival at the job, only a few seconds are required to load, meaning the maximum number of hauls, and it weighs less than other similar bodies.

A New Line of Portable Air Compressors

THE WB line of portable air compressors, made by the Buhl Co., Old Colony Building, Chicago, Ill., offers an air compressor for every need of the contractor in the portable field. These compressors are supplied in 30, 55, 90, 100, 110, 220 and 330-cubic-feet displacements, mounted on

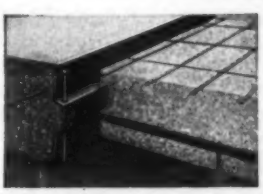


Side View of the New Buhl Type WB-110 Compressor Mounted on Steel Wheels With Solid Rubber Tires

There's No Delay When You Use TRUSCON HIGHWAY PRODUCTS

ALL FROM ONE SOURCE OF SUPPLY

Standardize on Truscon Highway Products. Then you will have no delays and you will get your job finished on schedule time. Everything comes to you from one source of supply and you will get all your materials when you need them. You know this means savings for you and no hold-up on the job. Truscon furnishes a complete line of Highway Reinforcement, including Welded Steel Fabric, Construction Joints, Round and Square Rib Bars, Curb Bars and Road Forms. Carried in stock for immediate delivery by Truscon warehouses and dealers.

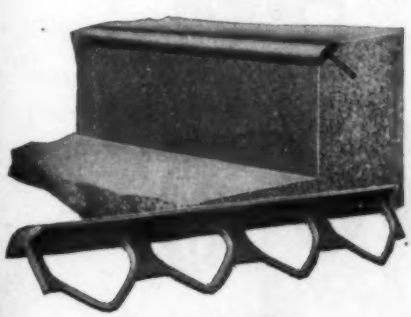


Truscon Dowel Contraction Joint

Truscon Welded Steel Fabric

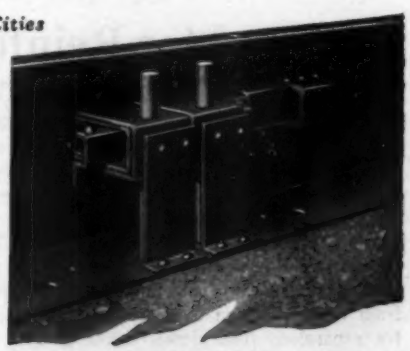
TRUSCON STEEL COMPANY
HIGHWAY DIVISION
YOUNGSTOWN, OHIO

Warehouses and Offices in All Principal Cities



Truscon Curb Bar

Truscon Rib Bars

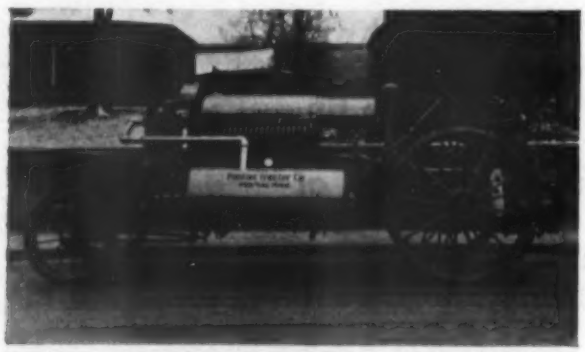


Truscon Road Form

solid iron wheels, on skids, or on solid rubber tires, and with steel housing.

This new line has been redesigned from the wheels to the air tanks. All parts for the new Buhl, except the crank shaft on one size or type, are interchangeable on all sizes and types. This includes all connecting rods, pistons, bearings, piston-rings and valves. Steel housing is standard equipment. It offers complete protection against the elements, can be quickly and easily removed or replaced, and but one lock is required for each side. These compressors have a one-piece cast steel frame, new cylinders, new dual valves, new housing and new working parts, each designed to synchronize properly with every other part. It is claimed that the new compressors operate as smoothly as the finest automobile engine. There is a remarkable lack of vibration.

Hardened bronze-backed replaceable bushings are used instead of many cheaper possible constructions. The cylinders are ground and honed, and the valve areas are double those of most other compressors. Standard equipment includes air cleaners on both the compressor and engine, a gasoline strainer, an automatic unloader and an engine slow down control.



The Pontiac Tractor Which Goes With a McCormick-Deering Tractor

A Backfiller Winch for Tractor

A BACKFILLER winch which operates in connection with the McCormick-Deering tractor, has been announced by the Pontiac Tractor Co., Pontiac, Mich. The backfiller is designed to mount with either the Pontiac air compressor or the Pontiac-Lincoln arc welder and when mounted with the compressor, allows the operations of backfilling and tamping at the same time.

The winch has a single drum with a clutch and brake. It takes its drive from the power drive shaft of the tractor at the rear and is mounted on the frame at this point. The unit is mounted so that it can be operated on either side of the tractor and is controlled from the driver's seat.

Sleeves for Reinforcing Dowels and Form Bolts

THE use of dowels placed through the expansion joints on concrete roads is becoming standard practice in many states. Where proper care is not taken in placing these dowels and providing space for expansion, great damage results from expansion of the dowels. A heavy waterproofed chip board sleeve has been developed by the Cleveland Container Co., 10630 Berea Road, Cleveland, Ohio, which slips snugly over the end of the dowel and is stopped automatically ¾-inch from the end by an inner sleeve which provides ample room for expansion. This dowel sleeve is now standard for state highway construction in New Jersey and is also used by contractors in a number of other states. These dowel sleeves are

The Cleveland Reinforcing Dowel Sleeves

supplied in any lengths and diameters desired.

As a means of facilitating the removal of concrete form bolts, the Cleveland Container Co., has developed 3-ply paraffined paper tubes which are slipped over the form bolts and from which the bolts are removed when the concrete has set and the nuts have been taken off. The bolts slip out freely so that they may be used on many more jobs in a similar way. The paper tubes remain in the concrete. The use of these tubes results in a saving in the cost of form bolts and other tieing materials which do not need to be cut flush with the concrete as the ends of the paper tubes fit flush to the face of the wall and when the form is removed there are no projections. They result in a saving in labor because the form bolts can be removed by one man. The wooden forms are easier to remove because the paper tubes permit removal of all bolts first and then the forms may be lifted off without interference or damage. These tubes are supplied in any length or diameter thoroughly coated with paraffin at an average price of about one cent each. Where an extra long bolt is used two ordinary tubes may be used with a paper sleeve to cover the joint.

This company also makes a leak-proof paraffined chip board container with an inside diameter of 6 inches and a height of 12 inches for collecting samples of concrete. By the use of these containers samples can be taken on the job and cured without the loss of any moisture. They may be shipped promptly to a laboratory or readily stored on the job.

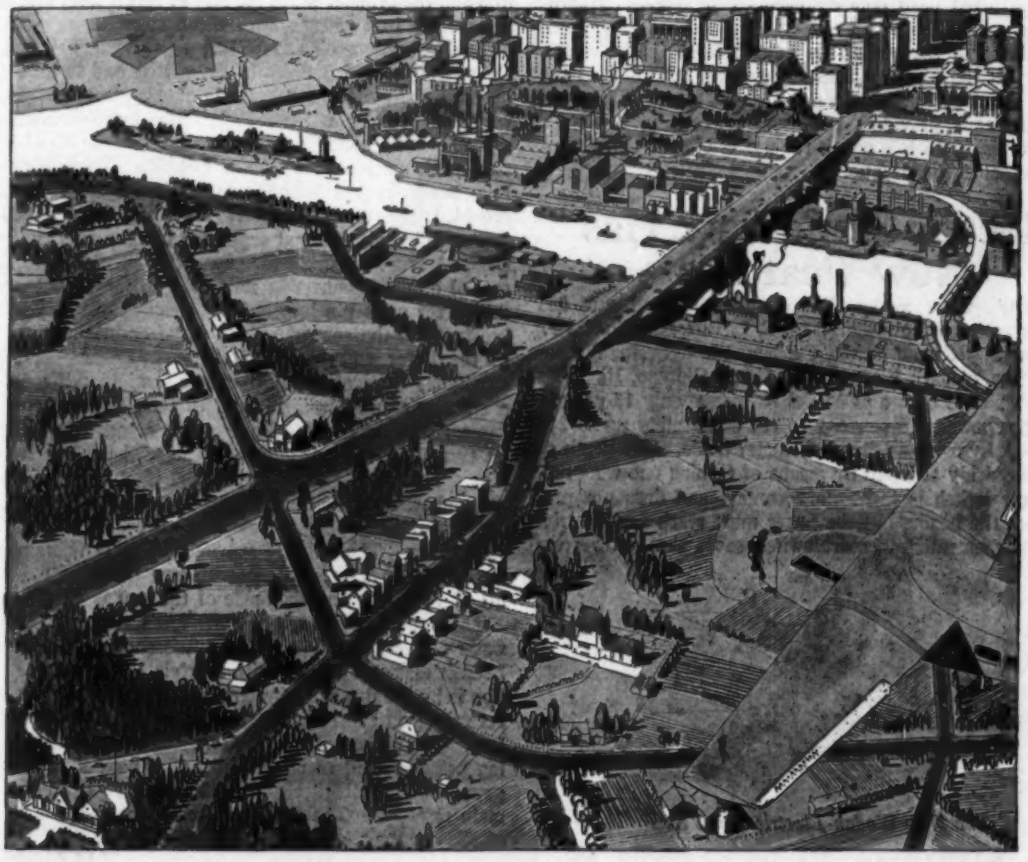
Scoop Conveyor for Material Handling

THE Ace scoop conveyor, for handling sand, gravel and crushed stone from hopper bottom cars to storage or trucks is manufactured by the Portable Machinery Co., Clifton, N. J. This conveyor has an Iron-clad belt which handles 20,000 tons of material without requiring renewal. The feed end is extra low and can be used without the end plate when feeding from piles. This minimizes the labor in feeding and speeds up loading. The discharge end of a 25-foot machine can be easily and speedily be adjusted vertically from 6 to 14 feet, thus giving a wide range.

The automatic chain take-up always keeps the drive chain

The New Ace Scoop Conveyor

THE BUSIER FUTURE



WHO cannot see the future taking form before his eyes? Air mail, airplanes, airports; super-sky-scrapers, vast rail terminals, stupendous industrial plants; faster automobiles, heavier traffic and wider, better roads.

The busier future will be retarded in its development without roads equal to the occasion. Where once the need was for highways, it is now for highway systems. Trunk-line highways are useless without modern "feeder" roads. Even airports cannot thrive without good roads to bring them trade.

Tarvia construction will provide rutless, storm-proof, smooth, skid-safe roads at a cost within the buying power of any community. Tarvia maintenance will keep them as good as new indefinitely and economically.

More to be done *than ever!*

Tarvia methods of salvaging and rejuvenating old highways make the highway dollar go farthest. Costs are low and results uniformly satisfactory.

The Tarvia representative in your territory will gladly discuss the details with you. Phone, write or wire.

The Barrett Company

New York	Chicago	Philadelphia
St. Louis	Minneapolis	Boston
Detroit	Cleveland	Birmingham
Buffalo	Kansas City	Columbus
Providence	Syracuse	Milwaukee
Baltimore	Toledo	Cincinnati
Lebanon	Youngstown	Rochester
		Bethlehem

In Canada:
THE BARRETT COMPANY, Ltd.
Montreal, Toronto, Winnipeg, Vancouver

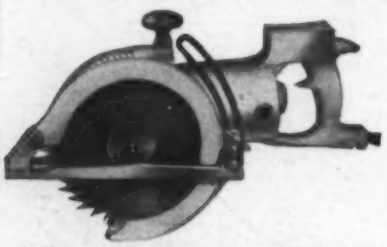
Tarvia
For Road Construction Repair and Maintenance

at the proper tension and eliminates the necessity of inserting or removing links when the head pulley is adjusted. A specially constructed head pulley prevents belt slippage, regardless of the load or the weather.

The balance of the machine is adjustable so that one man can easily lift the feed end from the ground, regardless of the weight of the power unit or the presence or absence of a screen attachment, thus providing maximum portability. A baffle plate is furnished with a screen for use where the delivery of clean material is important.

Electric Hand Saw Has New Features

A NEW junior model Wodack electric hand saw has recently been announced by F. L. Rogers & Co., 23-27 South Jefferson Street, Chicago, Ill., exclusive distributors for the Wodack Electric Tool Corp., Chicago, Ill. This new saw, which is known as Model K, weighs only 15 pounds, but has the power and capacity to cut any lumber up to 2⅝ inches thick by using an 8-inch diameter blade. The depth of the cut is quickly adjusted by means of turning one wing nut. The trigger switch is momentary contact and does not protrude from the handle but the finger must reach for the trigger. This momentary contact switch saves the motor from



The New Wodak Electric Hand Saw

running uselessly and also serves as a double protection to the operator.

Another feature is the saw-dust blower which brings the air down through a hose to the saw teeth and blows the saw-dust off the line the operator may be following. In ripping lumber a rip gage is provided to save marking the board at all.

This model can be used for all kinds of cutting, including stone and other hard materials for which an abrasive or carborundum blade is furnished. All Wodack saws have the swing guard operating by gravity and without springs. This guard is never in the way but performs its function when it is necessary.

The saw is equipped with a ½-horsepower General Electric Universal motor and operates from any electric light socket.

Four-Cylinder Industrial Engines for Heavy Duty

A COMPLETE new line of four-cylinder, 6½- and 7½-inch stroke, industrial engines of the slow speed type, designed for continuous and dependable heavy duty, has just been put into production by the Continental Motors Corp., Muskegon, Mich. These new models, eight in number, will be known as the Red Seal Continental H 21 to H 28.

These engines are designed for durability, economy and accessibility and have such features as removable cylinder sleeves, overhead valves, large crankshafts with five main bearings, dry sump oiling systems and built-in-governors.

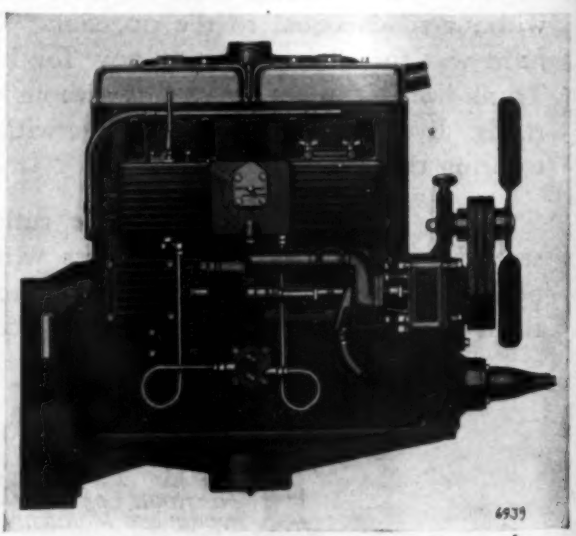
The engine is of the four-cylinder, vertical, valve-in-head type. The cylinder bores in the eight engine sizes range from 5 to 6¾ inches. The piston stroke in the four smaller sizes is 6½ inches and in the larger sizes 7½ inches. The horsepower ranges from 39 in the smallest engines of the series to 125 in the largest and the recommended governed speed is 1,000 r.p.m.

The removable sleeve cylinders are made of hard nickel iron and the cylinder heads are also of nickel iron, cast in pairs. The nickel iron pistons have three compression rings 3/16-inch wide, and one oil control ring ¼-inch wide, all four above the wrist pin, which floats in the piston and is held endwise by snap rings. The crankcase is of gray iron, cast integrally with the cylinder water jacket. The flywheel housing is a separate unit, bolted to the crankcase. The flywheel is of semi-steel, machined to take a Twin-Disc single plate clutch. Five bronze-backed babbitt, shim-adjusted main bearings are provided for the crankshaft, which is drop forged steel, dynamically balanced and supported in cantilever type bearing caps. A front extension for power transmission is supplied on special order. Connecting rods are of drop forged steel, rifle drilled for wrist pin lubrication. Removable phosphor bronze bearings are the connecting rod upper ends, and spun babbitt in the lower ends, which are shim-adjusted. The starting crank has a revolving grip handle, and is self-contained in a starting crank housing bolted to the gear case cover. Exhaust and intake manifolds are cast separate, with the outlet turned up at the center and threaded for 3-inch standard pipe. The camshaft, located at the right-hand side, has five bronze-backed babbitt bushings. The timing gear mechanism consists of three 1¾-inch wide, spiral cut, heat-treated alloy-steel gears. The exhaust valve is of silicon-chromium, and the intake of chrome nickel, with port diameter 2¼-inches, a lift of 7/16-inch and the angle of the seat is 45 degrees.

The water pump is of the gear driven, centrifugal type, with water outlets over the exhaust valves and ports. The fan has 24-inch diameter blades, with a triple V-belt drive. Lubrication is by the dry sump system, with the oil reservoir high and accessible on the camshaft side, its capacity being three gallons. The oil pump is of the two-stage, gear-driven type, giving pressure feed to all bearings at a normal pressure of 40 pounds. The oil filter and sediment basin form part of the main reservoir. The relief and regulating valve is in the end of the camshaft, accessible through the gear case cover.

Ignition is by a high tension magneto, the equipment including magneto switch cables, cable-holder and set of ⅞-inch standard spark plugs. The governor is of the gear-driven centrifugal type, located directly under the carburetor, which is of the vertical, 1¾-inch standard, SAE flange, balanced type, located on the left side of the motor, opposite the camshaft. The air-cleaner is of the filter type, with oil-wetted element.

The motor is provided with three-point support, the front trunnion being cast integrally with the gear case cover.



The Model H-24 Red Seal Industrial Engine

The Problem ~

Points to consider in selecting culverts and drains: No. 1*

7 ways at once.... your culverts must make good

1 Shifting soils
2 Weight of fill
3 Settling foundation
4 Impact of traffic
5 Pressure of freezing water
6 Pressure of swelling soil
7 Corrosion of Metal

The Answer ~

the Armco flexible pipe—
it cannot break—it endures

23 years of actual service under America's roads, has proved conclusively that Armco corrugated iron culverts successfully withstand each of the seven conditions of culvert service.

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand.

ARMCO CULVERT MFRS. ASSN.
MIDDLETOWN, OHIO

ARMCO

ARMCO CULVERTS

*No. 2 of this series appears in April

"Look under your roads"

© 1929, A. C. M. A.

A New Burner for Road Torches

DEPENDABILITY is the fundamental requisite of a torch which is to be used by contractors, highway departments, public utilities, etc., for protecting work in progress against accidents at night. The Toledo Pressed Steel Co., Toledo, Ohio, has recently filed patents on a new burner design which it is said improves the familiar Toledo torch. It is claimed by the makers that this new burner construction insures a flame whether the torch is out in a heavy downpour, sweeping gale or a combination of both. It is

The New Burner for the Toledo Torch

further claimed that the more severe the weather the better these torches will burn with this particular burner.

The new burner consists of a perforated cap and removable wick holder conveniently mounted on a collar on the torch and designed to maintain constant and more complete combustion of the fuel. It is said that a saving of over 50 per cent of the fuel may be expected through the use of this burner and that there is practically no consumption of the wick. While this new burner is so constructed that it is not interchangeable with those supplied in the past without an adapter, the Toledo Pressed Steel Co., has provided for taking care of old users by an adapter which may be attached to the old torch and which it is explained duplicates the results obtained with the new burner.

A New 2½-Yard Shovel

A NEW 2½-yard shovel, known as the Bucyrus-Erie 75-B has recently been put on the market by the Bucyrus-Erie Co., Erie, Pa., to fill the gap between its 2- and 3-yard shovels. As compared with the 2-yard shovel, the 75-B gives a 25 per cent larger output, loading 150 to 200 tons of rock per hour under average working conditions and more under favorable conditions while it is as easily moved and handled as the 2-yard shovel.

In design and construction, the Bucyrus-Erie 75-B is similar to the 3- and 4-yard shovels. All machinery is easily accessible and arranged to allow plenty of room inside the house. The business end of the 2½-yard machine is made up of a sturdy box girder boom straddled by two outside handles. The dipper handles are as long as those of the 3-yard shovel and the boom only 6-inches shorter, thus giving a working radius nearly as great.

The New Bucyrus-Erie 2½-yard Power Shovel

In the truck frame all propelling gears, except those of the last reduction, which are enclosed within the girder castings of the mounting, are above the bottom clearance of the clutch frame. The hoist, like that on the 3- and 4-yard shovels, is a single hitch twin rope.

The main machinery is all mounted on one single steel casting of deep section that forms the forward part of the revolving frame. Pin connected to this front casting and forming a ballast box is another casting which carries the motor generator set. The back legs of the A-frame are connected to the forward casting. The front legs are fastened to the main machinery frames, and because of the compression in the legs, the bolts which hold these frames are relieved of much of the strain caused by the pull on the hoist rope. The A-frame is all under the roof.

As on the 3- and 4-yard shovels, Ward-Leonard multi-voltage control with separately excited direct current motors is used.

The 75-B is a shovel for the medium-sized quarry. It has the power and strength to handle the toughest kind of digging and where the duration of the job warrants electric installation, it serves very well for a heavy construction job. It may be used, equipped with a 3¼-yard dipper, behind 12- and 16-yard strippers for loading and is available as a dragline excavator.

Side Suction Centrifugal Pump

THE Morris side suction centrifugal pump, driven by a gasoline engine or electric motor, and mounted on a substantial hand truck, is a new pumping outfit for contractors' use which is manufactured by the Morris Machine Works, Baldwinsville, N. Y. It may be carted from one job to another, used for water supply or dewatering, and handles either clear, clean water or water containing mud, sand and gravel.

The Morris Side Suction Centrifugal Pump Mounted on a Trailer

The pump, which is designed for heavy duty, is equipped with an open impeller having large waterways to permit handling solids and trash. The impeller-shaft is extra heavy with a ball thrust bearing to resist the end thrust, and the hub bearing is especially designed with water seal to prevent the leakage of air.

The engine is equipped complete with magneto ignition, gasoline tank, jacket water circulating pump and starter and universal joint on the shaft.

The Story of ACCURACY in Neptune-built Meters

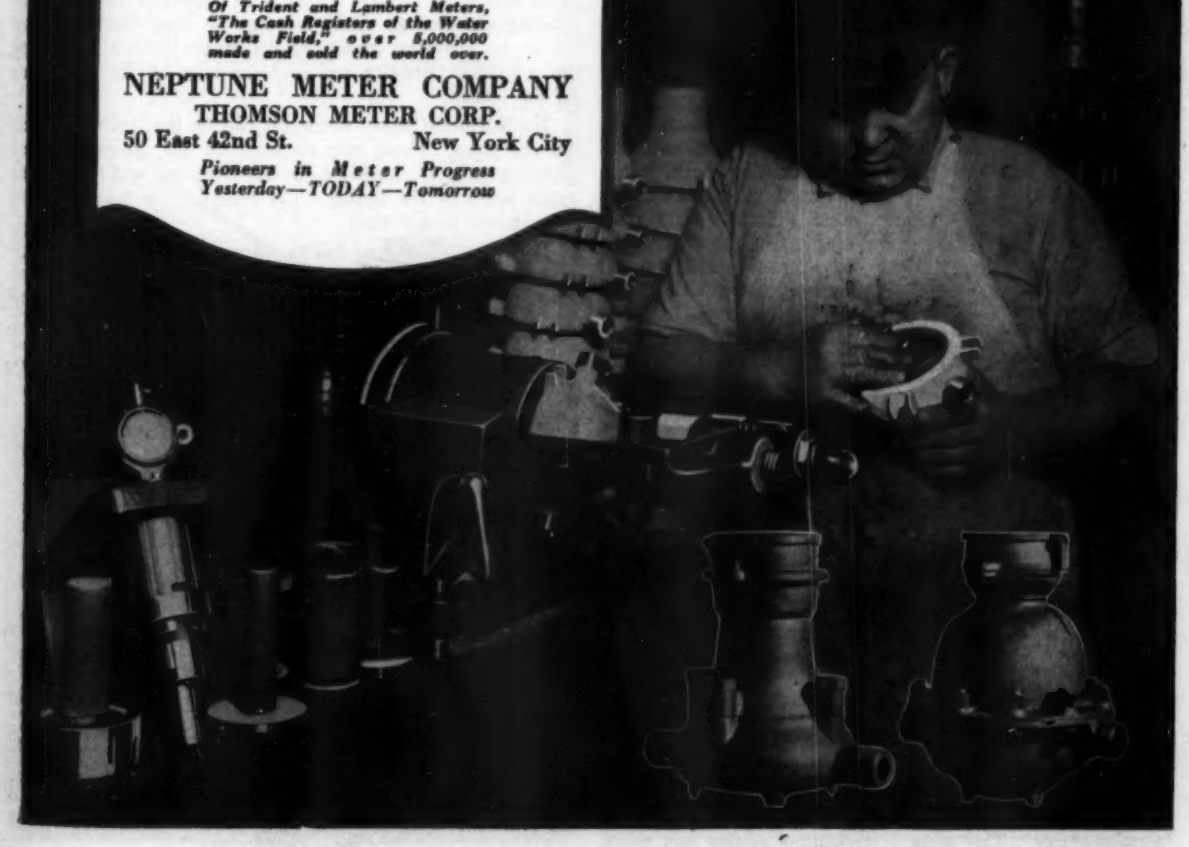
CHAPTER 8
OF A SERIES

Gauging for the future....

Years from now, if a new gear train or a disk chamber is ordered for that Neptune-built main casing, it must fit smoothly, exactly.
The gauges shown are used to measure the diameters and depths of the different sizes of main casings, within very close limits. The cutting accuracy of the *machine* is not enough. The expert tests each finished casing with many gauges to *make certain*—typically Neptune!

Of Trident and Lambert Meters, "The Cash Registers of the Water Works Field," over 5,000,000 made and sold the world over.

The Symbol of SUSTAINED ACCURACY



NEPTUNE METER COMPANY
THOMSON METER CORP.
50 East 42nd St. New York City

Pioneers in Meter Progress
Yesterday—TODAY—Tomorrow

The subbase on which the pump and driver are mounted is of structural steel. The wheels and axles which are supplied with the unit can be detached if desired, so that the subbase can be made to serve as skids, and holes are provided in the subbase to permit lifting the unit as a whole.

This outfit is suitable for capacities of from 300 to 900 gallons per minute, depending on the suction lift and discharge head to be served and the speed at which the engine is operated.

A Portable Flood Light

A NEW portable flood light for use in construction work and which delivers 5,000 candle power is sold by the National Carbide Sales Corp., 342 Madison Avenue, New York. This light, known as the National Carbide V G, is a self-contained unit, weighing but 30 pounds when empty and 75 pounds when fully charged. Three-fourths of the 75 pounds is at the base of the light so that it is not easily tipped over. However, should it be tipped over, it can be righted and will go on working again as the water and carbide are sealed in separate compartments.

The Portable V G Flood Light

The light operates on the "carbide to water" system. The carbide is automatically dropped into the water by the feed plunger, the only moving part, in even amounts to maintain a full steady flame. This system is used in all welding generators but is exclusive in the National Carbide V G flood lights.

Both the water tank and the carbide hopper are pressed steel drawn from open hearth box annealed deep drawing stock, which is tinned inside and out and then painted. The only opening in the water tank or generator proper is sealed by a special rubber gasket which fits in the recessed ends of the hopper tank. The joint is made gas tight by means of two swing bolts and nuts.

The light is 12½ inches in diameter, 39 inches long when folded and extends to 4½ feet when set up for use.

Clamshell for Use With Light Crane

A NEW general service ½-yard clamshell bucket for excavating and rehandling work is announced by the G. H. Williams Co., Erie, Pa. This bucket is especially designed for use with light cranes and truck cranes.

This new bucket which is known as the Universal is entirely of steel, from head roller to digging teeth. One of its important features is the lining up of the sheaves on the power arm, on which either roller or plain bearings may be used interchangeably. This gives a straightline closing pull which

The New Williams One-Half Yard Clamshell Bucket

increases the bucket's digging power. By combining the lever and block-and-tackle in the Williams power arm, power is built up with a shorter cable overhaul, and the tandem sheaves, giving the straightline closing pull, get entirely away from side leads of cable. This is an important factor in fast opening and closing. Extra leverage for hard digging is built up in the Universal bucket by the corner bar bracket design, the brackets extending out over the edge of the back plate of the scoops.

The scoop has heavy renewable digging lips, extending clear up the sides. These help to maintain the scoop alignment which is held at the hinge by the large full width one-piece main hinge of the bucket. The teeth of the bucket are of high-carbon forged steel.

It is an easy one-man job to put on or take off the counterweights for this bucket. One counterweight is hung on a heavy rib cast the full width of the main hinge and the second counterweight telescopes over it.

A Trackson Shovel Mounted on a McCormick-Deering Tractor on a Grading Job

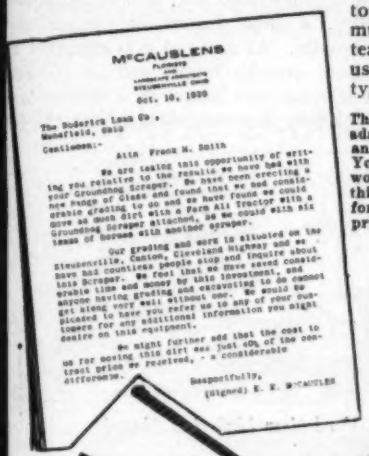
"GROUNDHOG"
REVOLVING TRACTOR SCRAPER

Solves Another Grading Problem

In this case a prominent Landscape Architect equipped with "Groundhogs" was able not only to compete with, but reduce the cost of grading to two-fifths of the price of a contractor who did not have them.

Mr. McCauslen's letter reproduced here states—

"One Groundhog attached to a tractor could move as much dirt as six teams of horses using another type of scraper."



McCAUSLENS

Oct. 10, 1930

The Roderick Lean Co.,
Mansfield, Ohio

Gentlemen:-

Attn Frank H. Smith

We are taking this opportunity of writing you relative to the results we have had with your Groundhog Scraper. We have been erecting a new frontage of Glass and found that we had considerable grading to do and we have found we could give as much dirt with a Farm All Tractor with a Groundhog Scraper attached, as we could with six teams of horses with another scraper.

Our grading and work is situated on the Steubenville, Canton, Cleveland Highway and we have had countless people stop and inquire about this Scraper. We feel that we have saved considerable time and money by this investment, and anyone having grading and excavating to do cannot get along very well without one. We would be pleased to have you refer us to any of your customers for any additional information you might desire on this equipment.

We might further add that the cost to us for moving this dirt was just 40% of the contract price we received, - a considerable difference.

Respectfully,
(Signed) E. E. McCAUSLEN

The "Groundhog" is adapted to use with any type of Tractor. You should know the working advantage of this scraper. Write for literature and prices.

THE RODERICK LEAN COMPANY
Dept. 9
Mansfield, Ohio
U. S. A.

A long lever regulates the depth of cut—enables the operator to bite as deep as he wants and to stop loading instantly—no stalling, no overloading—the control for loading, dumping and spreading is simple and positive.

The
"GROUNDHOG"
REVOLVING
TRACTOR SCRAPER

ANNOUNCING

the New

ONE-HALF BAG AND FULL BAG

KWIK-MIX
CONCRETE MIXER

TRAILERS WITH POWER LOADER

A new addition to the greatest KWIK-MIX line ever put on the market is the model shown above, a one-half-bag and full-bag tilting mixer on two-wheel, spring-mounted roller-bearing trailer truck featuring the new, patented Power Loader and Skip Shaker.

The new 3½-LT and 5-LT KWIK-MIX are low, compact mixing units that handle both concrete or cold patch for general construction and road maintenance work. Optional engine equipment. Get our

New, Low Prices

Full particulars upon request, including a complete catalog of the latest improved KWIK-MIX mixers in the tilting and non-tilting type. Also mortar and plaster mixers.

Send name and address today.

KWIK-MIX CONCRETE MIXER CO.
Department 150
Port Washington **Wisconsin**

A Miniature Screw Jack

AS AN attractive novelty, a paper-weight and a useful small tool and mechanical toy, Templeton, Kenly & Co., Ltd., 1020 South Central Ave., Chicago, Ill., is manufacturing miniature Simplex Screw Jacks. This miniature was designed primarily to serve as a salesmen's demonstrator, but so many requests were received for this combination tool and toy, which measures only 3 inches high when closed, that Templeton, Kenly & Co., is manufacturing them and selling them at 35 cents each postpaid.

This miniature, which has all of the features of the 77 Big Jack made by this company, is finished in red, blue or green lacquer and packed in an attractive box.

The Simplex miniature jack can be used to raise bookcases, tables and other heavy objects about the house, or to spread boards, and for numerous odd jobs that will quickly occur to the handy man.

Actual Size of the Simplex Miniature Jack

A New Type of Gravel Washer

THE separation of gravel from even small amounts of clayey material and trash is not an easy matter. Having faced the situation of producing clean gravel from the bottom of the Pearl River in Mississippi reclaimed by a hydraulic dredge which brought up large quantities of gravel with some clay and vast quantities of watersoaked bark, twigs, leaves and rotten wood, A. M. Lockett & Co., Ltd., Queen & Crescent Building, New Orleans, La., developed the Pearl River gravel washer which has successfully produced clean gravel passing all specifications.

The Pearl River gravel washer works on the principle of the tumbling barrel with the dirty gravel entering at one end and the clear water entering the opposite end, the gravel and water each traversing the entire length of the barrel. In order that the gravel may be compelled to travel the full length of the washer the barrel is constructed in the form of a double cone, the gravel inlet end being longer and of a more gradual slope than the gravel outlet end.

At the point of largest diameter, a perforated plate is installed with a central opening. Attached to this plate are buckets which lift the gravel from the lower part of the large cone and discharge it through the central opening of the diaphragm into the shorter cone, whence the gravel passes out of the end opening due to accumulation, accelerated by suitable angle plates fastened to the inner surface.

The gravel gradually works its way along the longer barrel to the point of largest diameter because of the slope and on its way it receives an effective scrubbing with a stream of water, passing through in the opposite direction, having a velocity high enough to remove particles lighter than gravel and yet not interfere with the gravel in its forward travel.

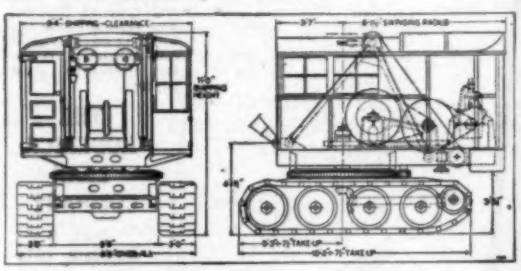
The washer revolves upon rollers which are on roller bearings, minimizing the power required to rotate the washer. While the quantity of water needed is fairly large it is not necessary to introduce the water under pressure, volume being the requisite. Therefore, the cost of operation is not excessive.

Up to the present, this washer has been m[illegible] from 10- to 20-yards, but as demands arise its range will be extended to larger units.

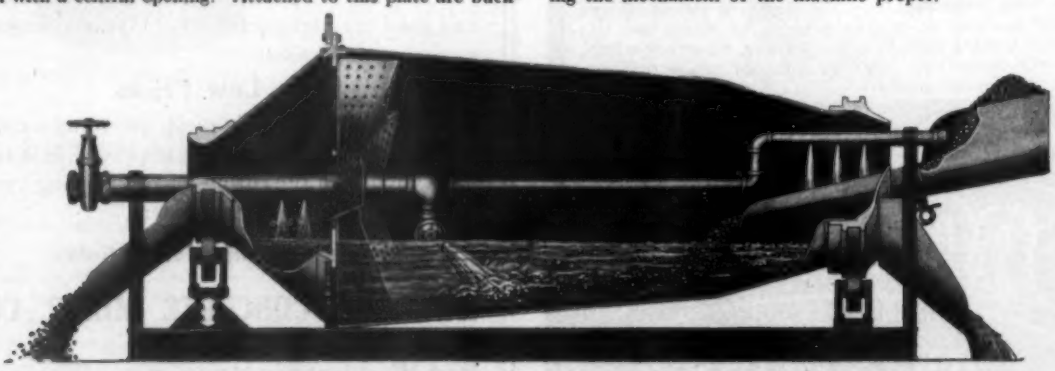
Heavy Duty ¾-Yard Shovel-Crane-Dragline

A NEW heavy duty ¾-yard shovel-crane-dragline has been announced by the Link-Belt Co., 30 West Pershing Road, Chicago, Ill. This new ¾-yard size, which is known as Type K-25, is rugged and fast, is liberally powered with a gasoline engine, a diesel engine or electric motor drive, and is easy to operate. As a shovel it is equipped with a ¾-yard struck-measure capacity dipper and as a dragline or crane it handles a ¾-cubic-yard bucket on a 40-foot boom.

It has typically Link-Belt features, such as the one-piece annealed cast steel lower frame, one-piece annealed cast steel rotating base, self-cleaning chrome steel crawler treads, large bronze-bushed crawler rollers, totally enclosed lower frame travel gears, running in oil, full steel house enclosing operator and machinery, unusually accessibility and comfort for the operator. It is easily converted from shovel to crane, dragline, trench hoe or vice versa, without changing or disturbing the mechanism of the machine proper.



The ¾-Yard New Link-Belt Shovel



A Cutaway Showing the Operation of the Pearl River Gravel and Sand Washer. Dirty Gravel or Sand Is Charged into the Machine at the Right, and the Clean Material Discharged at the Left

DOMESTIC

Reg. U. S. Pat. Off.

MODEL 164—TWO-DUTY DIAPHRAGM PUMP

MODEL 164, OPEN SPOUT DIAPHRAGM PUMPS

MODEL 164, DIAPHRAGM PUMP WITH FORCE DISCHARGE ATTACHMENT

This pump is so designed that all the best features of former models are incorporated and in addition new features permitting its use as either an Open Spout Discharge Pump or as a Force Discharge Pump as illustrated above.

In five minutes' time this "DOMESTIC" Model 164 Diaphragm Pump can be changed from an open Spout Discharge Pump to a Force Diaphragm Pump—or the reverse—and the only tool necessary is a monkey wrench.

When you have to force the water away from the job; force it up over the spoil bank; or, when, owing to the depth of excavation being too great for a suction lift, it becomes necessary to set the pump in the hole and force the water up—Just attach the fittings and your "DOMESTIC" Model 164 Diaphragm Pump Unit does the trick.

The "DOMESTIC" Model 164 will lift from a deeper trench and deliver more water than any other diaphragm pump we have ever seen.

Write us for descriptive bulletins.

DOMESTIC ENGINE & PUMP COMPANY, Shippensburg, Penna.

—Manufacturers—

Columbia "3-C" Brand

FOR CONCRETE CURING

Calcium Chloride

FOR DUST PREVENTION

SAVE TIME in concrete road construction by speeding up the cure with "3-C" Calcium Chloride.

It is no longer necessary to take 21 days for curing as required by ponding or earth or straw curing. With "3-C" Calcium Chloride even better results are achieved in seven days. Fourteen days saved! Costs reduced! Profits increased!

Let us give you complete information about this modern, progressive step in concrete road building. We not only have free literature for distribution, but our technical staff, with its mass of valuable data, is at your service.

Write, or send the handy coupon, today.

"3-C" 77% - 80% Calcium Chloride is packed in 100-lb. waterproof bags and in new size steel drums containing 400 lbs.

COLUMBIA CHEMICAL DIV.
Pittsburgh Plate Glass Co.
BARBERTON ◆ ◆ ◆ OHIO

Columbia Chemical Division,
Pittsburgh Plate Glass Co., Barberton, Ohio.
Please send complete information on the use of "3-C" Calcium Chloride for curing concrete.

Name .....
Street .....
City ..... State ...
OEM 229

A Truck Body with Concrete Agitator

THE problem of the transportation of mixed concrete from the central mixing plant to the job and at the same time maintaining a perfect mix is one of considerable importance to all contractors. A new piece of equipment in this line is the agitator truck body which has recently been announced by the Blaw-Knox Co., 667 Farmers Bank Bldg., Pittsburgh, Pa. The principle of the agitator truck body is simple. The concrete is proportioned and properly mixed

The Blaw-Knox Agitator Truck Body in Raised Position, Showing Blades Which Prevent Segregation of Concrete

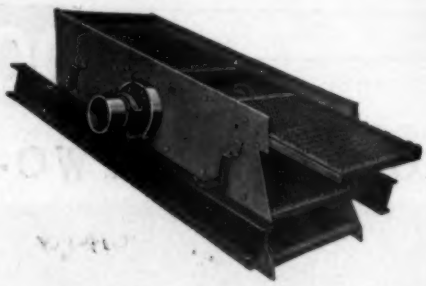
by a trained operator under the required supervision and inspection at a central mixing plant. The concrete is then transported to the job in the agitator truck, which is designed simply to keep the concrete constantly in agitation. The method is such as to prevent any segregation for any mix, whether dry or wet, the agitating mechanism not only stirs in the circular cross section of the body but keeps the concrete in constant circulation along the length of the body, thus insuring complete agitation.

Tests have showed that by using this method of transportation there is no segregation and that the concrete is more workable.

Counterflow Screens With One, Two or Three Decks

COUNTERFLOW screens which operate on the rotary principle and handle a variety of material from 6-inch opening to 300 mesh are manufactured by the Niagara Concrete Mixer Co., 40 Pearl Street, Buffalo, N. Y. These screens are made in five models of one, two or three decks each, making a total of fifteen models in different styles and sizes.

The frame is constructed of iron and steel throughout. The screen body runs on large specially designed roller bearings



The Niagara Triple-Deck Counterflow Screen

housed in grit- and dust-proof self-aligning housings with large reservoirs equipped with labyrinth seals. These seals serve to keep grit or foreign matter from entering the bearings.

The screen is operated on the rotary principle by means of an eccentric shaft of Hercules steel, mounted centrally on the screen frame proper, thus giving the screen a positive rotation on each revolution of the shaft. Through this arrangement of positive rotation at high speed, the materials are constantly kept turning while traveling on the screen surface. All bearings, housings, seals and main drive shafts are ground finish and held with 0.0005-inch.

These screens range in sizes from a screen area per deck of 4½ square feet, with a length of 4 feet, a height of 16 to 22 inches and a weight of 400 to 600 pounds, to a screen area of 24 square feet, with a length of 7 feet 6 inches, a height of 15 to 30 inches and a weight of 1,500 to 3,000 pounds. Model 1, the smallest, can be secured with either one or two decks and all other models may be secured with either one, two or three decks.

An Improved 5-Ton Industrial Locomotive

WIDER end sills, running boards, chain guards and cab are among the improvements which have added to the convenience and effectiveness of Brookville 5-ton gasoline locomotives made by the Brookville Locomotive Co., Brookville, Pa. The same change has been incorporated in all models and the McCormick-Deering power unit is used as standard equipment.

The 10-20 McCormick-Deering industrial tractor is used intact other than discarding the wheels, front axle assembly and other small fittings inessential for locomotive purposes. The frame of the locomotive is heavy ship channels with the end sills made up of heavy castings with four coupling pockets, high or low pockets being optional on the part of the pur-

The New Brookville 5-ton Gasoline Locomotive

Boosting Excavating Profits

Contractors are turning, more and more, to Sauerman Slackline Cableways for the handling of both little and big excavating jobs where the materials have to be dug, elevated and conveyed from the pit.

The money they are saving by the low first costs, low operating costs, etc., is represented by the increase in net profits. Write for the *Excavating for Profit* booklet and see how you can do the same.

SAUERMAN BROS., INC.
464 So. Clinton St. Chicago

THE SANDERSON CYCLONE DRILL CO., ORRVILLE, OHIO

DRILLS
and drill tools for every kind of Big Blast Hole Drilling
Catalog Mailed on Request

"The Strongest Geared Power for Its Weight in the World"

Capacity 5 Tons Straight Line
—
POSITIVE INTERNAL BRAKE

Weight 110-lbs.
—
Size 16x17x13-in. high
—
Two Speeds 4 to 1 24 to 1

Price $80 F. O. B. Warehouse Points, Chicago, Brooklyn, New Orleans, Houston.
Dealers in Principal Cities

Write for descriptive circular with users' endorsements and name of nearest dealer.

BEEBE BROS.
3219 First Ave., So. Seattle, Wash.

HOISTING BLOCKS
* STAR BRAND *
Are Always Reliable
Made for
Every Condition of Service
Sold by
Leading Supply Houses
Let us help you with your problems

BOSTON & LOCKPORT BLOCK CO.
NEW YORK BOSTON CHICAGO

Dependable Power
in sizes ranging in H. P. from 3 to 160

Le Roi Company
Milwaukee

LE ROI ENGINES
for dependable power!

HONHORST TAR HEATERS
"Built for service"
ALL STYLES
Portable and Stationary
25 to 200 gallons

See our page in Street Construction Section, Municipal Index, for the Kettle you need.

Write for Pamphlet No. 15 on the New Oil Burning Heater

THE JOS. HONHORST CO.
1016 W. 6TH ST. CINCINNATI, O.

The UNION No. 9 MIDGET HAMMER

Designed to come within the weight range of the pavement breaker and the rock drill type of hammer, and at the same time do more work with less air consumption.
Weighs 97 pounds, delivers over 250 blows per minute and strikes a 275-pound blow.

Send for copy of new catalog No. 124 on "Pile Driving Machinery and Foundation Equipment"

UNION IRON WORKS
Builders of Double Acting Pile Hammers since 1906
West Shore Siding Hoboken, N. J.

"TEN TIMES MORE LIGHT"

"Ten times more light than an oil lantern, and at less cost"—

This remark by a railroad man explains why thousands of National Carbide Lanterns are being used today by contractors, miners, tunnel workmen, street repair crews, and others who want a dependable, strong, clear and penetrating light.

NATIONAL CARBIDE SALES CORP.
342 MADISON AVE., NEW YORK

chaser. The driving axles are 2-15/16 inches in diameter, of special high grade steel. A dual system of brakes using cast iron shoes on all four drivers and also the standard McCormick-Deering emergency brake through the driving mechanism on all four drivers are used. There are sanders on the four drive wheels for both forward and reverse work. The drive on the Brookville locomotive is positive on all four drive wheels, the McCormick-Deering axles being merely used as jack shafts to transmit power to the lower shafts. There are three speeds forward and three reverse speeds. The standard ranges are 2, 4 and 10 miles per hour, and 1½, 3 and 7½ miles per hour. In occasional instances where operating conditions make it desirable to attain higher or lower speeds than the standard Brookville speeds, these can be obtained without extra cost by special sprocket gear ratios.

The drive wheels have standard steel tires with 1⅛-inch wheel flanges and a 4-inch face. With the exception of narrow gages such as 24 or 30 inches, special drivers for wood rails can be furnished. The locomotive is made in all standard gages from 24 inches to 56½ inches. The wheel base of the locomotive is 42 inches.

A Double Drum Gasoline Hoist

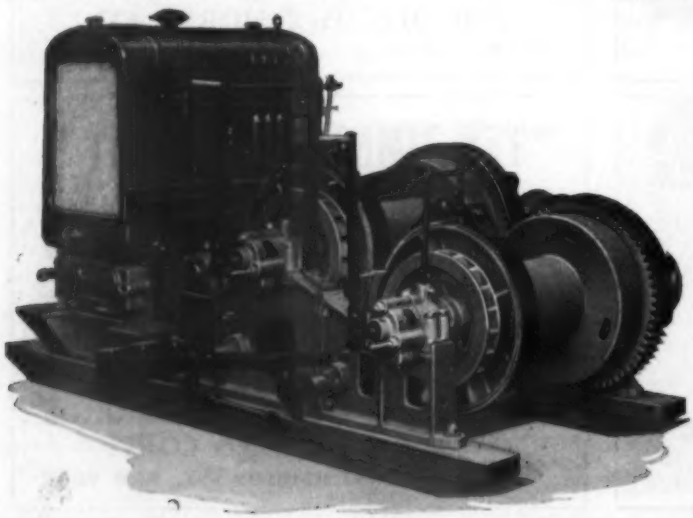
A COMPLETE line of gasoline hoists ranging from 12 to 125 horsepower in single, double and triple drum models is manufactured by the National Hoisting Engine Co., Harrison, N. J.

The model shown in the illustration is the double drum gasoline hoist with from 35 to 50 horsepower, which is designed for derrick work, material elevating, concrete towers, pile driving and general hoisting service of this nature. It is equipped with machine cut gears.

Among its features are double cone friction, silent chain drive, brakes on separate flanges, and motor equipped with a free engine clutch and extended throttle control handle. For drag scraper work the top drum diameter is increased to return the empty bucket at high speed.

The 35 horsepower hoist with drums 12 inches in diameter and 18 inches in length has a line pull of 3,500 pounds and weighs 5,800 pounds, and the 50 horsepower hoist with drums 12 inches in diameter and 18 inches in length has a line pull of 5,000 pounds and weighs 6,500 pounds.

If desired, these hoists can be furnished with a simply constructed swinging gear attachment.



The New National 35-50 Horsepower Double Drum Hoist

A Speeder ½-yard Dragline Shaping Up the Shoulders on Iowa State Highway No. 32

Speeding Shoulder Construction on New Road

THE William Horrabin Contracting Co., Iowa City, Iowa, made use of a new idea in building shoulders on new paving during the 1928 season when they used three Speeder ½-yard excavators, two draglines and one shovel, for that purpose on their job on Highway No. 32 in Poweshiek County, Iowa. Re-shouldering with a light dragline or shovel proved highly successful. The yardage handled averaged from 400 to 600 yards per day depending upon the depth of the cut. Moving was an easy matter as the draglines traveled on the pavement while the shovel cut its own roadway in the ditch and cast the spoil to the shoulder area.

The illustration shows one of the draglines reaching for a bucketful of earth to be dumped in the 6-foot shoulder radius. This Speeder was equipped with a 30-foot lattice type live boom and a ½-yard dragline bucket. In completing the operation required to move the necessary dirt the operator would simply throw his bucket to the bank directly adjacent to the 6-foot shoulder line, fill it, hoist, swing, and dump. Leveling off became an easy matter when it was discovered that this could be accomplished by dragging the bucket over the spoil. One man was needed for finishing with a rake and shovel, and another for sloping the banks near telephone poles and trees, which the operator could not reach with the bucket. The ditches were cut to the entire satisfaction of the highway engineer in charge and the surplus material was loaded into trucks. Due to the fact that the excavator was equipped with electric lights there was considerable night work done throughout the season.

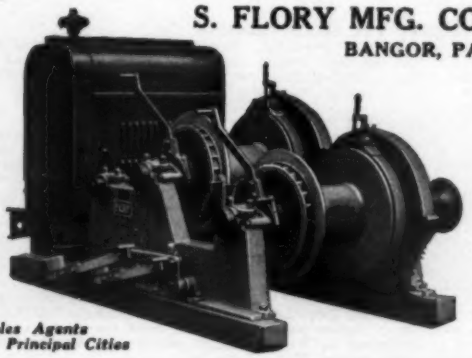
FLORY

FLORY'S NEW HOIST
THE "FLOR-OX" 35
HAS THESE REMARKABLE FEATURES

Roller-bearing thrusts for friction clutches, less weight and space with greater efficiency, positive release device on friction levers, Alemite lubrication, extra heavy shafts and bearings, silent chain-drive enclosed in dust-proof casing, machine-cut teeth on all main gears and pinions, and a rope pull of 5,000 pounds at 165 feet per minute, with either a gasoline or electric motor.

Write for Bulletin.

S. FLORY MFG. CO.
BANGOR, PA.



Sales Agents in Principal Cities

Yes—as we expected—'twas quite a hit at the Road Show last month

You may have missed it, but we'll tell you all about it if you'll send for our illustrated booklet. If you're looking for a

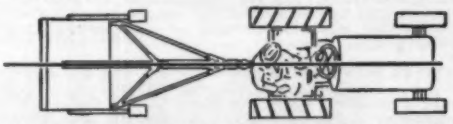
LABOR-SAVING, ONE-MAN-OPERATED, EASY-TO-RUN TRACTOR-SCRAPER—

you'll find what you want in the

SCHAEFER

What's more—you'll find it extremely low in upkeep cost.
Four stock sizes: 4, 5, 6 and 7 feet wide

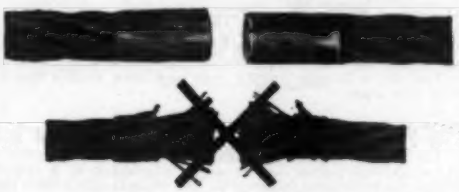
The Gustav Schaefer Company
Established 1880
4180 LORAIN AVE. CLEVELAND, OHIO



KEEPS TRACTOR AND SCRAPER IN LINE

The new Auxiliary Back-Up Control is handy for Short Hauls, for Excavating and for Back-Filling. It operates the scraper back-and-forth like a shuttle. It's not necessary to turn the tractor around.

The New Way To Cut Cable—



(1) One man whips and cuts any size up to 1" in less than a minute.

(2) Leaves cut ends incased in steel band—the ideal whip for passing through fixtures and fittings.

(3) Easily carried in kit (weight 8 lbs.)*

(4) No frayed ends—no cut hands—no delay.

* Larger cutter for 1½ in. cable: weight 20 lbs.

Starrett Steel Band and Cable Cutter
Write for Prices and Details
MORSE-STARRETT PRODUCTS CO.
1916 Broadway Oakland, California

Vibrationless Compressors

Avert a Harbor Fire

The oil tanker Seminole ran aground at Liverpool! Twenty-five tons of oil lay over the harbor. Eight thousand tons more had to be removed, to refloat the Seminole.

But electric or steam pumps could not be taken aboard. A spark falling on the deck or into the water would start a fire—periling other ships and miles of decks.

But the contractors used compressed air—to pump the oil out of the Seminole through a 12-inch pipe line, and into another tanker. They hooked up their two *Vibrationless* Compressors with several other borrowed compressors, on the deck. And compressed air was jammed through a hose into the Seminole.

Every day, new uses are found for compressed air. For even where hand labor might be used—and where it is cheap — it can no longer compete with the dependable air power of *Vibrationless* Compressors.

Send for Catalog 383-F

Sullivan Machinery Company
162 S. Michigan Ave., Chicago

© Sullivan Mchy. Co.

A SELECTED LIST of USEFUL MATERIAL

These especially selected catalogs and pamphlets of value to contractors are for free distribution.

You will find it worth while to check these lists each month and write for the catalogs you need.

A CARBIDE LANTERN
The National Carbide Sales Corp., 342 Madison Avenue, New York, will be pleased to send to any one interested a complete description of its carbide lantern which gives a clear and penetrating light for contractors, miners, tunnel workmen and others needing illumination for their work.

SILENT CHAIN DRIVES FOR 60 HORSEPOWER
Silent chain drives ranging from ⅛ to 60 horsepower are now available from stock without the inconvenience of waiting to have one made to order, according to Book No. 725 of the Link Belt Co., 300 West Pershing Road, Chicago, Ill.

GRADER BLADES
Grader blades for all makes of graders or drags as well as snow plow blades, grader and snow plow moldboards, scarifiers and rooter teeth grader structurals and steel frames are manufactured by the Shunk Manufacturing Co., P. O. Box 37-C, Bucyrus, Ohio, who will send literature on request.

CENTRIFUGAL SELF-PRIMING PUMPS
Bulletin 29-C of the LaBour Co., Chicago Heights, Ill., contains a complete description of the LaBour centrifugal self-priming pumps, made in various sizes for portable or stationary use, with either electric or gasoline drives.

ENGINES IN MANY SIZES
The LeRoi Co., Milwaukee, Wis., will be pleased to send to those interested a complete description of its LeRoi engines for all kinds of construction equipment and which range in sizes from 3 to 160 horsepower.

GRADER WITH MANY FEATURES
Literature describing the Rome graders, which have many features including a special open-hearth steel frame, heavy steel moldboard, disc wheels, heat-treated gears, Timken thrust bearings and Alemite lubrication may be secured from the Rome Manufacturing Co., Rome, N. Y.

NEW ONE-MAN SCRAPER
The new Schaefer scraper which features a back-up control operating the scraper back and forth like a shuttle and eliminating all turning of the tractor and which is operated by one man is described in a circular which may be secured from the Gustav Schaefer Co., 4180 Lorain Ave., Lorain, Ohio.

COLD PATCH ASPHALT
Standard cold patch asphalt for repairing bituminous macadam roads, as well as other asphalts and road oils is described in literature which may be secured from the Standard Oil Co. of New York, 26 Broadway, New York.

ENGINES FOR INDUSTRIAL MACHINERY
Literature describing Stover inbuilt engines to supply power for industrial machinery may be secured from the Stover Manufacturing & Engine Co., 15 Lake Street, Freeport, Ill.

PILE DRIVING MACHINERY AND FOUNDATION EQUIPMENT
A new 112 page well illustrated catalog completely describing pile driving machinery, cableway skips, air locks, tunnel shields and equipment for sub-aqueous foundation work may be secured from Union Iron Works, Inc., W. G. Schalscha, Sec., Hoboken, New Jersey.

PORTABLE ASPHALT PLANT
A complete description of the Model E-3 portable asphalt plant, a mechanically operated, self-propelling machine for mixing hot asphalt directly on the street where the work is being done, may be secured from the Chausse Oil Burner Co., 1227 West Beardsley Avenue, Elkhart, Ind.

STEEL SHEATHING FOR ROOFS
The Blaw-Knox Co., 667 Farmers Bank Bldg., Pittsburgh, Pa., will be glad to send to any one interested a complete description of their galvanized steel sheathing for roofs which is light weight, strong, fireproof and impervious to dampness.

STEEL SCRAPERS FOR ALL PURPOSES
Steel scrapers in a variety of styles and sizes are described in a recent folder from the American Steel Scraper Co., Sidney, Ohio.

HELMET GOGGLES FOR WELDERS
Among the accessories for welding and cutting described in literature of the Oxweld Acetylene Co., 30 East 42nd Street, New York, are the new Oxweld cap and skeleton type goggles which are very durable and offer considerable protection to welders.

SELF-CONTAINED DIE STOCKS
The new Beaver die stocks which are handy, self-contained, light in weight, durable and have interchangeable parts, are described in a folder which may be secured from the Borden Co., Warren, Ohio.

WIRE ROPE FOR EVERY PURPOSE
A 48-page booklet describes in detail the wire rope of all kinds for every purpose, including hoisting, transmission, cable construction, tiller and zinc-coated ropes which are manufactured by the Hazard Wire Rope Co., Wilkes Barre, Pa.

IMPROVED INDUSTRIAL LOCOMOTIVES
Wider sills, running boards, chain guards and cabs are among the improvements which have been added to Brookville 5-ton gasoline industrial locomotives, complete information on which may be secured from Brookville Locomotive Co., (B. Eisenman, Mgr.) Brookville, Pa.

WET WALLS AND EFFLORESCENCE
This is the title of a complete and well illustrated booklet which explains what efflorescence is and how to avoid it, with examples showing the results of neglect and which may be secured upon request from the American Face Brick Assn., 130 North Wells Street, Chicago, Ill.

NEW BURNER FOR ROAD TORCHES
The Toledo Pressed Steel Co., Toledo, Ohio, has developed a new burner for the familiar Toledo torch which insures a flame in a heavy downpour, sweeping gale or a combination of both for protecting work in progress against accidents at night.

METAL LATH DATA BOOK
A 92-page booklet, entitled the "Truscon Metal Lath Data Book," containing a complete description with illustrations of metal lath, its advantages, uses, complete specifications and the various types and related products which are manufactured by the Truscon Steel Co., Youngstown, Ohio, may be secured from them by asking for book No. 415.

AN IMPROVED FAST CRANE
A number of new improvements in the Manitowoc-Moore Speedcrane has been announced by the Manitowoc Engineering Works, Manitowoc, Wis., in recent literature which they will be glad to send to those interested.

DUMP BODY HOIST FOR LIGHT DUTY TRUCKS
The Heil No. 1 Junior hoist for use on light trucks up to 1½-ton capacity is described in Bulletin H232 which may be secured from the Heil Co., Milwaukee, Wis.

A CONCRETE CURING PROCESS
A recent booklet of the Barber Asphalt Co., 1600 Arch Street, Philadelphia, Pa., describes in detail the Curcrete process for curing concrete by treating the concrete immediately after spreading with an emulsion of bitumen.

A 3-JAW CRUSHER
A new jaw crusher which combines three crushers in one and reduces in one operation any class of material ordinarily fed to crushers to a product passing a ½-inch screen, is described in a recent bulletin of the Bakstad Crusher & Equipment Corp., 122 South Michigan Avenue, Chicago, Ill.

DUAL WHEELS FOR LIGHT TRUCKS
The Erie Malleable Iron Co., Van Metal Wheels Division, Erie, Pa., will be glad to send to those interested a complete description of its Van dual wheels for Chevrolet 1-ton trucks which enable the operator to carry four 30 x 5 tires on the rear and thus double the carrying capacity of the truck.

SHOVEL WORKS IN ALL CLIMATES
A shovel which works equally well at a temperature of 30 degrees below or 135 degrees above, which has direct-connected air-cooled engines for crowding and swinging and is easily converted to a clamshell or dragline excavator is manufactured by the Bucyrus-Erie Co., Erie, Pa., who will be glad to send a description of this shovel to any one interested.

NEW HEAVY DUTY PAVER
The new Koehring paver, having simplified automatic actions and controls and made for heavy duty service, is described in literature which may be secured from Koehring Co., Milwaukee, Wis.

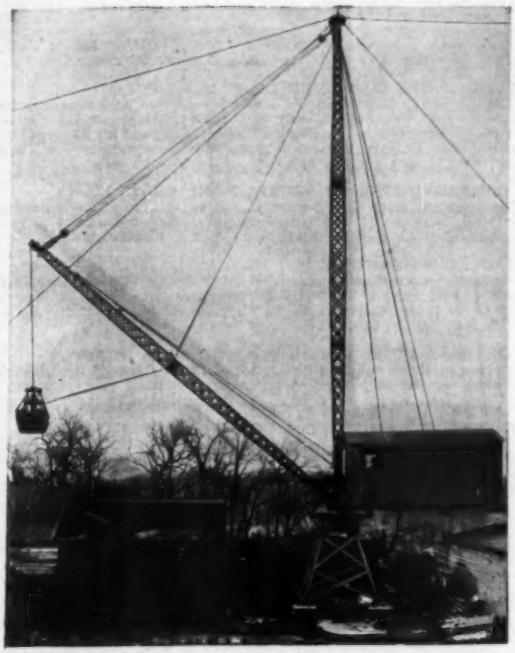
A MATERIAL HANDLING TRACTOR
A circular describing the Gerlinger hydraulic lift haul carrier which consists of a high frame, capable of carrying loads 3 feet wide by 3 feet high and of any length, through city streets, or narrow alleys and even in and out of box cars, may be secured from New York Air Brake Co. (W. M. Van Ostrom, Sales Mgr.), Carrier Division, 420 Lexington Ave., New York.

NEW METHOD OF CONCRETE PAVING
Compressed concrete, the new method of constructing and Armourplating portland cement concrete pavements, is described in a booklet which may be secured from the American Vibrolithic Corp. (L. R. MacKenzie, Pres.), 933 Insurance Exchange Bldg., Des Moines, Iowa.

PLOW OR ROOTER FOR ROAD WORK
A sturdy and durable 2 in 1 plow which can be converted into a rooter simply by removing the steel point wing is described in a booklet which may be secured from the Wiard Plow Co. (S. J. Hunt, Sales Mgr.), Batavia, N. Y.

CONCRETE MIXERS FOR ALL USES
Catalogs describing the complete line of concrete mixers, made in all sizes and types for all uses, may be secured from the Leach Co., (E. C. Leach, Pres.), Oshkosh, Wis.

DOBBIE DERRICKS



A DERRICK FOR EVERY PURPOSE

Stiff Leg and Guy
Steel and Wood
Hand or Power Operated

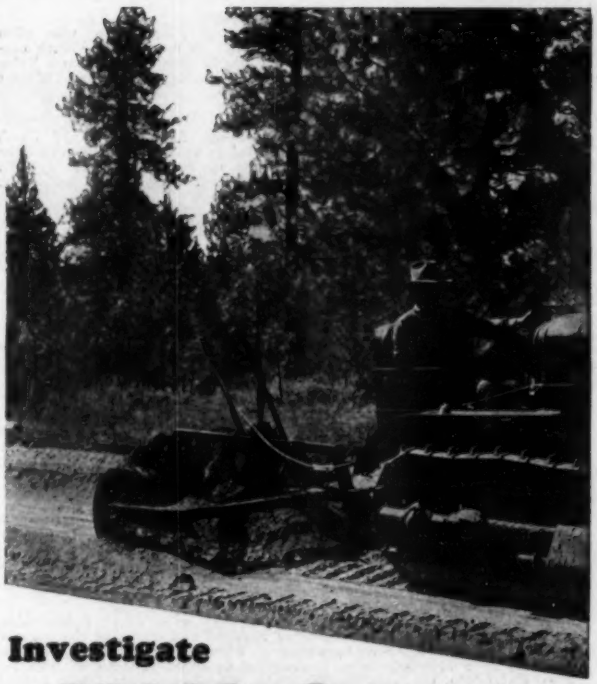
Send for Details on
Full Rotating Derrick and
Hammer Head Cranes Especially Adapted
for Central Mixing Plants!

DOBBIE FOUNDRY & MACHINE CO.
Niagara Falls, N. Y.
Distributed by
The Mundy Sales Corporation
30 Church Street, New York City

DOBBIE DERRICKS

Sheaves—Hand-Winches—Blocks

Complete Stock Carried at Niagara Falls—
Also G. S. Green Co., 74 Warren Street,
New York City, N. Y.



Investigate

Killefer Scrapers

if you want outstanding performance. You will find in these unusual scrapers--

A new development in steel for the shoes—
Quick, simple size-of-load adjustment—
An accurately adjusted "bite"—
Bolted-in, reversible, double blades—
Ease of control—by the tractor operator—
A full line in sizes from 4' to 8' wide, capacities from 18 to 105 cubic feet, dirt measure—
The whole line strong, heavy, fairly priced.

Our 5' model is shown above. These tools have been 6 years on the American market. There are hundreds of enthusiastic users. Sales Agencies thruout the United States and Canada. For descriptive literature write Killefer Mfg. Corp., 5525 Downey Road, Los Angeles.

WIRE BAR TIES FOR CONCRETE WORK
Wire bar ties and the tying tool for use in tying rods or wire when reinforcing concrete and which will be found to speed up the work considerably is described in literature which may be secured from Bates Valve Bag Corp., (E. T. Statler, Sales Promotion Mgr.), 35 East Wacker Drive, Chicago, Ill.

EQUIPMENT FOR THE ROAD BUILDER
The Sullivan Machinery Co. (S. B. King, Adv. Mgr.), 162 South Michigan Avenue, Chicago, Ill., will be glad to send to those interested its 1929 catalog describing its complete line of air compressors, busters, spaders, drills, drill sharpeners, hoists and other equipment of use to the road builder.

AN IMPROVED SHEAVE-BLOCK FOR SCRAPERS
Sauerman Bros., Inc. (Louis McLouth, Adv. Mgr.), 464 South Clinton Street, Chicago, Ill., will be glad to send to those interested literature describing its new Durolite dragline block which has a number of new and improved features.

NEW DRAINAGE PUMP OPERATED BY OUTBOARD MOTOR
A new type drainage pump, weighing 85 pounds, which is powered with a Johnson outboard motor and which is unique in that it is self-priming and will shut itself off when the supply of water to be pumped is exhausted is described in a booklet which may be secured from the Johnson Motor Co. (J. H. Sheldon, Asst. Adv. Mgr.), Waukegan, Ill.

A NEW SIX-WHEEL INDUSTRIAL LOCOMOTIVE
Complete information in regard to the new 20-ton, six-wheel, gear and side rod-drive Whitcomb locomotive for industrial hauling and switching may be secured from the George D. Whitcomb Co. (L. H. Cornelius, Adv. Mgr.), Rochelle, Ill.

NEW LINE OF MODERN PUMPS
A complete and modern line of diaphragm, centrifugal and pressure pumps, manufactured in a variety of styles and sizes, which has just been announced by the Chain Belt Co., 766 Park Street, Milwaukee, Wis., is described in the Rex Pump Catalog which will be sent to those interested on request.

NEW DIGGING MACHINE FOR EXCAVATING
A new type of digging machine which will cut a swath 8 feet wide, from 0 to 3 feet deep and as long as required and discharge the material in one continuous operation by means of a series of heavy-toothed buckets operated by a crowding drive is described in a recent bulletin which the Geo. Haiss Mfg. Co., Inc. (A. W. Haiss, Vice-Pres.), 142d Street & Park Avenue, New York, will be glad to send to any one interested.

CONCRETE TESTING
Complete information in regard to the service for testing and supervision of all classes of concrete construction as well as crushing concrete test cylinders to assure safety in the removal of forms may be obtained from Robert W. Hunt Co., 2200 Insurance Exchange, Chicago, Ill.

EXPANSION JOINTS FOR CONCRETE ROADS
W. R. Meadows, Inc. (W. R. Meadows, Pres.), Elgin, Ill., will be glad to send to those interested complete data in regard to its line of Sealtight products, including expansion joints, fillers and planks which insure maximum protection for concreting jobs.

DOUBLE DIAPHRAGM PUMPS FOR GREATER CAPACITY
The Humphyres Manufacturing Co., Mansfield, Ohio, will be glad to send to any one interested bulletins describing its double diaphragm pumps which are designed to develop higher vacuum, higher suction lifts and deliver large volume.

DISTRIBUTORS FOR TAR AND ASPHALT
The line of Champion bituminous distributors for use in the application of tar and asphalt in highway construction and maintenance which are made in six models and operate either from a power take-off or by means of an independent power unit is described in a booklet which may be secured from the Good Roads Machinery Co. (J. Warren Kitts, Adv. Mgr.), Kennett Square, Pa.

MATS FOR CONCRETE REINFORCEMENT
The Concrete Steel Co., 42 Broadway, New York, will be glad to send to any one interested a complete description of its Havemeyer electrically welded barmats, consisting of Havemeyer bars of specific sizes welded into a complete reinforcing mat for concrete, which is transported, handled and placed as a single unit.

PAVER HAS MANY FEATURES
The Ransome 27-E Master paver which has a number of outstanding features and is made in a variety of batch capacities is described fully, with illustrations, in a booklet "The Master Paver" which may be secured from the Ransome Concrete Machinery Co. (A. P. Robinson, Sales Manager), Dunellen, N. J.

PORTABLE CRUSHER FOR ROAD JOBS
Complete information in regard to the Wheeling traveling crusher which is a crusher mounted on a tractor for use in crushing stone along the road and which may be taken from one job to the next without dismantling the machine may be secured from Wheeling Mold & Foundry Co. (William H. Sallwasser, Mgr., Crusher Dept.), Wheeling, W. Va.

DRIVING AND PULLING PILES
In its 94-page Bulletin 37, the McKiernan-Terry Drill Co., 15 Park Row, New York, describes and illustrates the complete line of McKiernan-Terry double-acting pile hammers for all kinds of pile driving and pile pulling.

NEW MIXER HAS MANY IMPROVED FEATURES
The new 3½-yard Wonder mixer which has a number of new and advanced improvements in both the trailer and loader models is described in a new bulletin which may be secured by writing to Construction Machinery Co., Waterloo, Iowa.

A PNEUMATIC CONCRETE SURFACER
A pneumatic tool for finishing and smoothing concrete, eliminating form marks, finishing and polishing stone work, has been recently developed by the Chicago Pneumatic Tool Co. (H. H. Sherman, Mgr., Publicity Dept.), 6 East 44th St., New York, and is described in literature which may be secured on request.

DUAL WHEEL EQUIPMENT FOR TRUCKS
The W & K Websteel wheels, which are made for use on practically every truck, including Ford and Chevrolet, which are light in weight but have great strength because of forged steel spokes and proper distribution of all stresses, are easily cleaned and make for increased tire milage are described in literature which may be secured from Whitehead & Kales Co., (H. O. Mainzinger, Sales Mgr.), Detroit, Mich.

A SKIMMER-PULLSCOOP EXCAVATOR
A new 16-page bulletin describing in detail Model 4 Keystone skimmer-pullscoop excavator for all types of trench and cellar excavations has recently been published by the Keystone Driller Co., Beaver Falls, Pa., and may be secured by writing to J. V. Downie, Adv. Mgr.

BUCKET WITH IMPROVED FEATURES
The Universal bucket, having a number of new and improved features including a combination of lever and block-and-tackle, and a double arch design, is described in the Bucket Book which may be obtained from G. H. Williams Co. (A. J. Lichtinger, Asst. Sales Mgr.), 609 Haybarger Lane, Erie, Pa.

A COMPLETE LINE OF SHOVELS AND CRANES
New catalog describing the complete line of Byers shovels and cranes for 1929, with a 1¼ to ½-yard capacity, may be secured from Byers Machine Co., (G. G. Kingsbury, Sales Mgr.), Ravenna, Ohio.

SUBGRADING EQUIPMENT
Complete information in regard to subgrading equipment, including form graders, road rooters, trail graders, templates, scarifiers and planers, will be sent to those interested by E. G. Carr, Pres., Ted Carr & Co., 939 North Avenue, Chicago, Ill.

A CREEPER DUMP WAGON FOR USE WITH TRACTOR
A creeper dump wagon with capacities ranging from 3 to 10 yards and designed for use with crawler tractors is described in a pamphlet which the Biehl Iron Works, Inc., Reading, Pa., will send to those interested.

AN IMPROVED FULLY CONVERTIBLE GAS SHOVEL
The Speeder Machinery Co., (Edgar McNall, Adv. Mgr.), Cedar Rapids, Iowa, will be glad to send to any one interested a complete description of its improved Model B 3½-yard full-revolving, fully-convertible gas shovel which can be used as a shovel, skimmer, crane, dragline or clamshell.

A NEW 1-YARD CENTER-DRIVE CRANE
A new Thew 1-yard center-drive crane-clamshell-shovel-dragline, known as the Lorain-55, and similar in design to the larger Lorain-75, is described in literature which may be secured from the Thew Shovel Co. (F. A. Smythe, Pres.), Lorain, Ohio.

A LIGHT-WEIGHT HIGH GRADE SHOVEL
The Baldwin Tool Works (H. Cunningham, Vice-Pres.), Parkersburg, W. Va., has developed the Monongah Featherweight Brand shovel to meet the demand of contractors for a light-weight, high grade tool. Literature on these shovels, which weigh approximately 46 pounds per dozen, will be sent on request.

AN ALL-PURPOSE DUMP TRUCK
A complete description of the new Omort dump truck and road builder which has an exclusive Omort and gate design whereby the operator can control the distribution and flow of materials entirely from the driver's seat can be secured from the Greenville Mfg. Works, Greenville, Ohio.

A NEW 10-S MIXER
A new side skip loading; non-tilting, 10-S mixer, equipped with roller bearings throughout and having a cast iron housing over the trunnion roller shaft packed with grease, lengthening the life of the machine and protecting the shaft from mud and concrete, has been developed by the Knickerbocker Co. (W. W. Du Pre, Sales Mgr.), Jackson, Mich., from whom complete information may be secured on request.

A TRACK-WHEEL DUMP WAGON
Bulletins describing the Euclid track wheel dump wagon, made in a variety of sizes and equipped with 12-ton track-wheels, may be secured from the Euclid Crane & Hoist Co., (A. P. Armington, Sales Mgr.),Euclid, Ohio.

A BRAND NEW SHOVEL
The Ohio Power Shovel Co., (Roy Wills, Adv. Mgr.), Lima, Ohio, has recently issued Bulletin 291 which describes in detail the new Lima-101 shovel which is new from digging teeth to crawlers and has wider working ranges, greater speed and more power and a patented single line hoist.

A CRUSHER THAT NEEDS NO FOUNDATION
The new Allis-Chalmers Newhouse, Style B, crusher with its large receiving opening, short, rigid main shaft and rapid crushing stroke meets modern requirements of low crushing costs and high crushing capacities. Literature describing this crusher which is supported by three-cable suspension may be secured from the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

A HEAVY DUTY TRUCK THAT ROLLS OUT RUTS
The Cleveland Crane & Engineering Co., Motor Truck Div., Wickliffe, Ohio, has developed the heavy duty 4-yard Cant-Rut Roller truck which has six rear wheels each equipped with a 12 x 36-inch tire, giving extra bearing surface which permits the trucks to travel over ground that would be impassable for ordinary trucks.

NEW MEDIUM WEIGHT MOTOR ROLLERS
Folder Serial No. 1048 of the Austin-Western Road Machinery Co., (H. F. Barrows, Adv. Mgr.), 400 North Michigan Ave., Chicago, Ill., describes and illustrates the new Austin Cadet pup roller, made in 5, 6, and 7-ton sizes along the same lines as the 10-ton Austin Autocrat.

BRANDS OF EXPLOSIVES AND THEIR USES
The Explosives Service Bulletin, containing a description of the various brands of explosives and a chart giving in a graphic manner the uses to which the various explosives may be put, may be secured from E. I. du Pont de Nemours & Co., Inc., (E. F. Carley, Adv. Mgr., Explosives Dept.), Wilmington, Del.

CRAWLER TREAD EXCAVATORS IN FIVE MODELS
Bulletin No. 60 of the Orton Crane & Shovel Co., (P. A. Orton, Jr., Sales Mgr.), 608 South Dearborn St., Chicago, Ill., contains descriptions and illustrations of the new Orton excavating and material handling equipment, including Model A, a ⅜-yard shovel; Model G, a 1-yard shovel; Model T, a ¾-yard shovel; Model W, a 1¼-yard shovel; and Model C, a 35-ton crane with a 60-foot boom.